INTELLIGENCE RESEARCH METHODOLOGY

An Introduction to Techniques and Procedures for
Conducting Research in Defense Intelligence

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INTELLIGENCE RESEARCH METHODOLOGY

CHAPTER I.
INTRODUCTION: HOW TO USE THIS BOOK

In intelligence production as yet we find little study of methods as such. Yet a systematic study of methods in any given field . . . nearly always leads to . . . improvement.

Washington Platt
1957

Purpose

This work was prepared for the students of the Defense Intelligence School who may be required to demonstrate their knowledge and skill in conducting their own research projects. It is conceivable that analysts and researchers on the job might find sections of the book useful, but the book was *not* prepared for *experienced* intelligence analysts or researchers. Above all, this book should not be construed as a text for training intelligence analysts, even though analytic processes and problems are described. The purpose of the text is to provide guidance to the inexperienced researcher who must thread his way through a tortuous maze of procedures and steps as he defines his research problem, collects his information, analyzes it, and prepares his report.

Although the book was prepared essentially for the candidate for the Master of Science degree in Strategic Intelligence, other students of the Defense Intelligence School who may be unfamiliar with the peculiarities of intelligence research may also find portions of the text useful. Numerous books have been written on research methodologies appropriate for various disciplines—history, education, psychology, anthropology, and so on. This book was prepared to fill a gap, namely, to describe research procedures and representative techniques specifically related to intelligence.

The Intended Reader

Students attending the Defense Intelligence School reflect a wide variety of academic backgrounds, prior assignments, skills, and service experience. For example, some students may have been in intelligence billets prior to their assignment to the School. For others, assignment to the School may be their first formal exposure to intelligence. As such, the book was prepared for a diverse body of readers.

Preparing a single book for a diverse body of readers poses problems. Obviously, not all of the content will be highly relevant to all of the readers, nor will all of the content be comprehended easily by all of the students. Therefore, it is suggested that the reader use the text selectively. Although the sequence of research phases is fairly ridigly established and pertinent to all kinds of research activities, the methodologies described in the later chapters should be examined primarily with an eye to possible application to the researcher's problem. The intent of the sections dealing with methodologies is not to train professional "methodologists." Instead, the intent is to familiarize the researcher with techniques that have been and are being used in intelligence research and analysis.

Readers vary not only in experience, but also in personal preferences and inclinations. Reading may be a relatively enjoyable task or pastime to some, but an onerous, time-consuming task to others. Regardless of personal proclivities, however, it is recognized that time is valuable to the reader and nonreader alike. Therefore, the purpose of this introductory chapter is to help the reader utilize his reading time most efficiently.

For example, students with much intelligence experience would probably need not read Chapter II, "Setting the Stage: An Overview of the Evolution of Strategic Intelligence Production," and Chapter III, "Inaccessible and Questionable Information: The Need for Intelligence." Readers with advanced degrees from other institutions who have also had much experience in intelligence, could probably skip Chapter IV, "Research: A Description of the Activity," Chapter V,

"Intelligence Research/Academic Research: Similarities and Differences," and Chapter VI, "Characteristics of the Intelligence Researcher," as well.

Many readers dislike theoretical discussions. Sometimes they are necessary, however. It is strongly recommended that all students read Chapter VII, "Types of Inquiry and the Nature of Proof," and Chapter VIII, "The Relation of Induction and Deduction to Theory Building in Intelligence Research," despite the fact that the chapters are "theoretical."

Organization and Content

From Chapter IX to the end of the book, the organization of the text follows the normal sequence of phases in performing research, from the planning phase to the preparation of the final report. There are major digresssions, however, particularly in the discussion of analysis, in which specific practices are considered in detail.

Major portions of the chapters relating to the analysis phase of a research project deal with specific methodologies. An attempt has been made to describe the various methodologies, and to show where and how they might be applied in intelligence research. However, since many of the methodologies would require volumes to describe in detail, this book cannot be considered a how-to-do-it manual for these methods. For detailed information on any specific methodology, the reader is advised to consult the works referenced in the various sections.

Obviously, not every methodology used in intelligence analysis or research has been described in this book. Many techniques are highly specialized and would require months of training before the researcher could apply them. Examples of these techniques would be photo and image interpretation and signal analysis. Psychoanalytic techniques referred to in the methodology sections would also require years of training. Therefore, techniques which the "average" student of the Defense Intelligence School might employ have been stressed.

Security considerations prevented the relating of certain techniques to specific situations. Here the imagination of the reader will be required to see exactly where and how a technique could have been used in a specific context. For example, one of the more universal analytic approaches involves the use of analogies. In instances in which the researcher is denied access to certain real-world data, he may have no other recourse than to fall back on analogous situations and infer from these. The potential fallacies of the approach are numerous, but, as discussed in Chapter V, intelligence researchers are required to arrive at conclusions despite the unavailability of reliable data. Where analogies are used in addressing current intelligence problems is not indicated in this text, but the reader can assume that the practice is universal.

Many examples cited in the text are genuine. However, for purposes of security, contexts may have been changed, and the perennial "other country" may have been substituted for a real name.

Any work attempting to encompass a topic as large as intelligence research methodology must, by necessity, exclude certain content. In this book, for example, details on report preparation—details relating to footnoting, forms and formats—have been excluded deliberately. This does not mean that these details are unimportant: but these details are treated much better in the referenced works that are devoted specifically to these topics.

CHAPTER II.
SETTING THE STAGE: AN OVERVIEW OF THE EVOLUTION OF STRATEGIC INTELLIGENCE PRODUCTION

If you know the enemy and know yourself, you need not fear the results of a hundred battles. If you know yourself, but not the enemy, for every victory you will suffer a defeat. If you know neither yourself nor the enemy, you are a fool and will meet defeat in every battle.

Sun Tzu

Intelligence research is an activity most commonly associated with strategic intelligence production. Strategic intelligence in the sense that it is known today is a fairly recent innovation which evolved from its predecessor, tactical (or "combat," or "military") intelligence. This section traces briefly the evolution of strategic intelligence. The thesis of this overview is that as methods of resolving conflict became more complex, so did strategic intelligence production become more complex.[1]

Organized Warfare and the Need for Intelligence

Organized warfare gave rise to the need for military and strategic intelligence. When conflict had to be resolved on a

[1]Dozens of books have been written since the end of World War II that trace the history of intelligence operations or production, or that describe the origin of a particular intelligence organization. Few books, however, surpass Richard Wilmer Rowan's *The Story of Secret Service* (Garden City, New York: Garden City Publishing Co., Inc., 1939). Admittedly dated, this book is not only scholarly, but also entertaining: a masterpiece of its kind.

man-to-man basis there was little need for intelligence. The principals knew each other and the field of battle was familiar to both combatants. When conflicts involved tribes, and later, when conflicts involved armies, conditions changed. Although combatants may have known who their adversaries were, they needed additional information. The necessity to move large groups of soldiers quickly and efficiently made certain types of knowledge imperative—knowledge of the terrain, location of the enemy, his strength, and his deployment. Apparently, it was recognized very early that the average soldier was not a suitable agent for procuring this information. Skillful, perhaps, in handling his weapon and formidable in endurance, the average soldier was not able to insinuate himself into the enemy ranks, was not able to estimate well, probably was not able to read nor record, and was hardly able to process mentally all of the needed information relating to the ability of an opposing force to do battle. Therefore, it is not surprising that early intelligence "systems" were built around spies and agents—those specialists who, either by training or by inclination, understood what kinds of information were significant, and were sufficiently cunning or deceitful to obtain it.

Agents and spies have always been a part of any covert intelligence system and will probably continue to be so. For example, prior to his campaign against Rome in the third century B.C., Hannibal infiltrated his agents into northern Italy, and undoubtedly one of their more essential elements of information related to passes through which Hannibal could move his cavalry and elephants.[2] Similarly, Genghis Khan in the thirteenth century used scouts for ground reconnaissance, but he also used well-placed agents for spreading rumors of his terror and intrepidity. Obviously, the Khan's systematic employment of rumor as a terror weapon exploited someone else's intelligence system, as unstructured as it may have been.

[2]For the researcher with a bent for "historical" intelligence analysis, determining the source of Hannibal's elephants might provide a stimulating diversion. Did the elephants come from India or from Africa? If they came from India, how did they make the trek westward? If they came from Africa, where were the herds located?

But it is significant to note that even as early as the Middle Kingdom of Egypt (1580-1150 B.C.), the necessity to obtain intelligence on a *regular* and *systematic* basis was perceived, and units were especially trained and employed to collect it. The Hyksos in Egypt, according to Field Marshal Bernard Montgomery, had an unusually effective intelligence organization which utilized a variety of communication media from torches to runners and employed special reconnaissance units to scout terrain and capture prisoners for interrogation. Interestingly, reports sent by officers to their superiors at headquarters had to indicate the source of their information—a practice which, with variations, is still practiced today by the U.S. intelligence community.[3] This is one of the earliest indications of systematic procedures for obtaining intelligence, but according to the Old Testament, there were procedures which even predated the Hyksos.

Sun Tzu: First Among Few Writers of a Very Old Profession

Aside from Biblical references, the first writer to document the importance of evaluated information about a real or potential enemy was Sun Tzu in 500 B.C. What enabled the wise sovereign and the good general to achieve things beyond the reach of ordinary men, according to Sun Tzu, was foreknowledge.[4] Clearly, today technology has changed the nature of the process of developing this foreknowledge, and the assertion by Sun Tzu that knowledge of the enemy's disposition can be obtained only from other men (spies) is indeed quaint in an era in which major powers employ satellites, where few secrets are held for long in the "ether", and where practically every emanation of the "other side"—heat, light, RF energy, seismic waves, and so on—are potential sources of intelligence

[3]Field Marshal Viscount Bernard Montgomery, *A History of Warfare* (Cleveland: The World Publishing Company, 1968), p. 39.

[4]Thomas R. Phillips, ed., *Roots of Strategy* (Harrisburg, Pennsylvania: The Military Service Publishing Company, 1955). *Sun Tzu On the Art of War*, by Lionel Giles, trans., pp. 60-1.

information. What is significant about Sun Tzu is not that he recognized the importance of intelligence, but that he recorded his maxims on the collection and evaluation of intelligence information. Sun Tzu's *Art of War* influenced Chinese and Japanese military thinking for over 2400 years, and even in recent times this classic was required reading for all of Mao Tse-tung's lieutenants.[5]

From the time of Sun Tzu to the Middle Ages, there is increasing evidence of intelligence as a necessary concomitant of warfare. Alexander's empire could not have survived as long as it did without Alexander's lieutenants possessing a knowledge and understanding of the customs of the conquered people.

Mithradates, a one-man intelligence staff and an intellectual genius who mastered twenty-two languages, collected his basic intelligence firsthand by wandering on foot throughout Asia Minor. During the first century B.C., his army constituted the gravest threat to Roman hegemony in the Mediterranean. Mithradates' knowledge of the external enemy was superior to his knowledge of the internal enemy, however, because he was unable to anticipate a mutiny in his own ranks.

Hannibal's employment of agents as part of his campaign against Rome was mentioned earlier; and Scipio, the nemesis of Hannibal, was equally adept at using information about the enemy's disposition to his own advantage.

The Roman general Suetonius Paulinus who, with 10,000 men, defeated 230,000 Britons in 62 A.D., had been a former intelligence officer in Africa in 47 A.D. His descriptions of the terrain and habitants—presumably intelligence studies—still survive.[6]

[5]Allen Dulles, *The Craft of Intelligence* (New York: Harper & Row, Publishers, 1963), p. 13.

Other than recorded instances of success or failure due to surprise (the very thing intelligence is intended to avert), very little has been recorded about early intelligence doctrine, methods, or procedures. One of the earliest examples of intelligence doctrine, however, is found in Vegetius' *Military Institutions of the Romans* (ca. 400 A.D.), and the tenets set forth about the importance of information of terrain, avenues of approach, and routes of march are still relevant today.

From the Middle Ages to the Renaissance little was recorded about the production or utilization of intelligence. This is strange, because significant and decisive events occurred during the period, for example: the battles of Tours and Hastings, the Crusades, the intercontinental campaigns of Genghis Khan and later Kublai Khan, and the battle of Crecy. From what details exist of the conflicts it would appear that intelligence played a very small role in determining the outcomes of these events.

With the exception of Genghis Khan, commanders apparently paid little attention to collecting or utilizing intelligence in any systematic way. Edward III, for example, had so little information about the terrain prior to the battle of Crecy that he had to bribe a local French peasant to guide his army to a ford in the Somme.

Emphasis on Internal Security versus External Threat

In the East, internal security was the dominant focus of all intelligence activities. During the Edo period in Japan, for

[6]It is interesting to note how many prominent military leaders spent at least a part of their careers in intelligence. Aside from Mithradates and Suetonius Paulinus, of course, there are Gordon of Khartoum, T. E. Lawrence, Orde Wingate, and Joseph W. Stilwell (as a military attache in Peking). All of these officers ultimately distinguished themselves as military leaders in those countries where they had served in some intelligence capacity.

example, the *metsuke* (spies, censors, and agents provocateurs) monitored activities of dissident elements;[7] and earlier, the *ninja*—perhaps the most versatile agents of all times—were trained and utilized in the martial arts of scouting and reconnaissance, and in the covert arts of political assassination.[8] Although the exploits of the *ninja* have been depicted in numerous Japanese motion pictures and television productions, the extent to which these tales are apochryphal is unknown. What is known, however, is that the evolution of the art of *ninjutsu* was influenced by the writings of Sun Tzu.

Likewise in the West, at least until the seventeenth century, more effort seemed to be devoted to internal security than to a systematic analysis of another country's capabilities and vulnerabilities. In part, this was a function of the spirit of the times in which court intrigue constituted perhaps more of a threat to a reigning monarch than did some foreign power; hence, Elizabeth had her Walsingham and Cromwell his Thurloe.

Systematic Strategic Intelligence Production Ignored: Some Hypotheses

Several hypotheses might be postulated to account for why relatively little emphasis was placed upon the systematic production of strategic intelligence. First, the element of surprise was difficult to maintain. Once a decision had been made to engage in an act of war, the signs were fairly obvious. For example, in 1587 it was common knowledge (at least to those to whom the information was important) that an armada would be dispatched from Spain. Admittedly, exactly when and from which ports an armada would sail were unknown initially. As a matter of interest, the timely raid on Cadiz by Drake set back the departure of the Spanish Armada by at least a year, and even Philip II did not know exactly when the Armada would be ready. When the Armada did set forth (after a series

[7] Edwin O. Reischauer and John K. Fairbank, *East Asia: The Great Tradition* (Boston: Houghton Mifflin Company, 1960), p. 607.

[8] Donn F. Draeger and Robert W. Smith, *Asian Fighting Arts* (Tokyo: Kodansha International, Ltd., 1969), p. 120 ff.

of storms which further delayed the departure), picket boats quickly alerted the English who had prepared for months for this engagement.

Another reason for the relatively little emphasis placed upon the production of strategic intelligence was the manner in which warfare was conducted. Military campaigns usually involved one or a series of set piece battles in which the personalities of the leaders—their audacity, tactics, modes of employing infantry, cavalry, and artillery—were known to the key participants.

Not only were personalities known to the opposing combatants, but also the tactics employed by all combatants were generally the same. Interestingly, when innovations were introduced, the results were indeed disastrous for the opposing side. For example, the Spanish intended to employ the Armada against the English in the same manner as they engaged the Turks in the Battle of Lepanto. Warships would make physical contact, and the infantry would board the English ships, clear the decks, and capture the ships. However, the English engaged the enemy by cannon and refused to close with the Spanish men-of-war. Thus, the tactic that worked so well in the past was useless against an innovative opponent.

Gustavus Adolphus of Sweden was an outstanding military innovator. He drilled his cannoneers to such a degree of perfection that his artillery could fire three rounds to the enemy's one. The high rate of fire combined with mobility made his artillery a terror weapon in the Thirty Years War. Gustavus was innovative in the field of intelligence as well. His addition of a "Chief of Scouts" to his staff predated by nearly a hundred years similar intelligence staffs in the French and German armies.

Still another reason why relatively little emphasis was placed on the production of strategic intelligence was that in the period between the Middle Ages and the mid-Renaissance conflicts were not global; hence, the necessity for large amounts of detailed information about terrain (other than routes of march), customs of the people, and so on, was not perceived to

be essential to the success of a campaign. One notable exception to "global conflicts," of course, were the Crusades, and today one cannot but be amazed at the audacity (or arrogance) of the first crusaders who, with little knowledge of the enemy's strength, terrain, routes of march, or logistics, nevertheless undertook a campaign that crossed a continent.

It should be stated that there may have been instances in which strategic intelligence was produced systematically on a global scale prior to the sixteenth century. Such systems, if they existed, were certainly not publicized and the extent and nature of their operations are unknown.

But one would not necessarily expect to find the details of the intelligence production activities publicized. Battlefield innovations became common knowledge after their introduction, but intelligence innovations, if they did exist, probably succeeded because little was known of them by the opposing side. Elizabeth, for example, would have been eager to have her court chroniclers document the successes of her reign—the New World explorations, the exploits of the privateers (after she broke with Spain), and the defeat of the Armada—but it is unlikely that she would have permitted anyone to document her agents' penetration of the court of Tuscany.

Precursors to the "Modern Era" in Strategic Intelligence Production

The latter part of the fifteenth century marks what might be called the beginning of the "modern era" in strategic and military intelligence production. This was the beginning of the era of global exploration and the beginning of the decline of dynastic rule, although dynastic rule would continue for another five centuries. This was also the beginning of the period in which the technology and techniques of warfare began to evolve rapidly. Gustavus Adolphus, mentioned earlier, was one of the first modern innovators, and others followed, such as Frederick the Great, and later Marlborough and Napoleon.

Like Vegetius more than a thousand years earlier, tacticians and strategists again began to formulate doctrine, and, significantly, military intelligence was an important element of this

doctrine. Admittedly dated, and perhaps quaint, the early precepts are nevertheless still timely. For example, writing primarily for Prussian officers, Frederick the Great fully appreciated the importance of information relating to the enemy's country, and his exhortation that "knowledge of the country is to a general what a rifle is to an infantryman and the rules of arithmetic are to the geometrician," is as pertinent today as it was in the mid-eighteenth century.[9]

Maurice de Saxe, who gained firsthand experience under Marlborough and Eugene of Savoy, stated in his *Reveries* some general rules for the interpretation of "signs"—those physical manifestations of battle which, if interpreted correctly, give some indication of the opposing army's intent. Although the interpretations of specific signs may no longer be pertinent, the act of drawing reliable inferences from commonplace signs is a procedure that is very relevant today to intelligence analysts and researchers.[10]

Despite the paucity of information relating to a government's systematic production of strategic intelligence prior to the seventeenth century, there is documentation attesting to other institutions' use (and production of) strategic intelligence. For example, one of the earlier instances of a non-governmental agency's strategic intelligence activities were those carried out by the various banking houses in Europe in the mid-sixteenth century.

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[9]Thomas R. Phillips, trans., *Frederick the Great, Instructions for His Generals* (Harrisburg, Pennsylvania: The Military Service Publishing Company, 1944), p. 47.

[10]Saxe wrote that when you hear much firing from the enemy camp, you may expect an engagement the day following because the men are discharging and cleaning their weapons. *My Reveries Upon the Art of War by Marshal Maurice de Saxe* in Phillips, *Roots of Strategy*, p. 292. ff. This is reminiscent of the WW II practice of Allied aircraft test firing their weapons shortly after takeoff and the standing operating procedure for U.S. forces in Vietnam to discharge the weapons in a perimeter defense shortly after daybreak.

But even prior to the activities of the large banking houses were the "strategic intelligence" activities carried out by Western traders and merchants in the Middle Ages. To these vendors, economic information, customs and practices, routes of communications, and political information relating to "target" Eastern countries and populations were critical to the success or failure of their enterprises. The extent to which merchants shared this information about their customers is unknown. But it is known that very little systematic use of this information was made by governments—a monumental blunder at a time when the East constituted the major strategic threat to all of Western Europe.

U.S. Intelligence Organizations: Newcomers to an Old Club

Compared with England, France, Spain, and Portugal, the United States is a relative newcomer to the international arena of power and politics; therefore, it is not surprising that the United States' history of strategic intelligence production is a short one. Although scouts and agents (and even detectives[11]) had been used to gather and evaluate intelligence about the opposing sides during the earlier conflicts in America, it was not until World War I that the necessity for producing strategic intelligence on a global scale became evident.

Having only a skeletal intelligence organization at the outbreak of World War I, the U.S. was forced to rely heavily upon the intelligence produced by the British and French. Although lessons were learned quickly and a cadre of intelligence personnel was trained, little remained of this cadre other than the organizational structure, during the interim between World War I and World War II.

In World War II, the U.S. again had to create a large-scale strategic intelligence production capability, and again the Americans learned much from their British counterparts. By the

[11]President Lincoln employed the Pinkerton Detective Agency to conduct the Union's intelligence operations during the Civil War.

time America entered the war, the British, with the participation of scholars, had developed massive amounts of global strategic intelligence.

It is significant that since the time of Elizabeth scholars have played an important role in strategic intelligence production. Elizabeth recruited her agents from Cambridge and Oxford. Scholars from these same institutions became the analysts and researchers who contributed so much to British expertise in World War II. In his introduction to J. C. Masterman's *The Double-Cross System in the War of 1939 to 1945,* Norman Holmes Pearson points out that:

> another contribution of British intelligence was that of so-called overt intelligence, by which scholarly sources, when studied by scholars, revealed information which had long since been gathered but already been covered by dust. Timetables for tides involved in invasion landings, the location of bombing targets within metropolitan areas, amounts of precipitation to provide against, and rainy seasons to avoid: these not-at-all trivial data emerged from otherwise ignored pages of books rather than from the impossibly delayed reports of agents. American intelligence services learned much from the British example of research and analysis carried on at the universities.[12]

Likewise in the U.S., General William Donovan, Director of the Office of Strategic Services, " '. . . assembled the best academic and analytical brains that he could beg, borrow, or steal from the universities, laboratories, and museums.' "[13] The Research and Analysis Branch of OSS, according to R. Harris Smith,

[12]J. C. Masterman, *The Double-Cross System in the War of 1939 to 1945* (New Haven: Yale University Press, 1972), pp. vii-viii.

[13]R. Harris Smith quoting Allen Dulles in *OSS: The Secret History of America's First Central Intelligence Agency* (Berkeley: University of California Press, 1972), p. 13.

. . . resembled a star-studded college faculty. A peek into the R & A offices might reveal a heated discussion between historian Sherman Kent and political scientist Evron Kirkpatrick. A committee meeting of the Economics Division might find Charles Hitch, Emile Despres, Charles Kindelberger, and Richard Ruggles sitting side by side. In other rooms, classicist Norman O. Brown could be writing a report on Greek politics, historian John King Fairbank studying an aspect of Chinese foreign policy, philosopher Herbert Marcuse analyzing German social structure, or anthropologist Cora DuBoise pondering the problem of European colonialism in Asia.[14]

World War II marks the real beginning of the U.S.'s strategic intelligence production capabilities. Although the names of intelligence organizations have changed and their missions have been modified, major intelligence organizations that exist today had their progenitors in World War II.

In recent years, the introduction of new weaponry has made the development of countermeasures imperative. Again, a change in the manner of resolving conflict has changed the nature of strategic intelligence production. Available time to react to new threats has been reduced drastically, and this reduction in response time makes adequate intelligence (foreknowledge) all the more important. The need for adequate intelligence has given rise to new intelligence collection devices which, in turn, require new technologies to handle the voluminous amounts of raw data collected daily. Yet, despite sophisticated collection devices and techniques, the man in the system is as important as ever. Automated data storage and retrieval systems make it possible to manipulate large quantities of data, but only the trained intelligence analyst or researcher can make judgments, draw conclusions, or derive meaning from data.

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[14] *Ibid.*

Summary

▷ Although the importance of strategic intelligence was recognized and documented as early as 500 B.C., little is known about the manner in which this intelligence was produced.

▷ Strategic intelligence activities by *governments* became apparent in Europe in the sixteenth century. Initially these activities were directed toward specific target groups such as political dissidents, a specific country, or a religious group.

▷ In the seventeenth and eighteenth centuries, strategic intelligence activities by governments began addressing global issues in a systematic manner.

▷ In World War I, and in the beginning of World War II, U.S. intelligence organizations had to rely heavily upon the intelligence produced by the Allied nations.

▷ Scholars and academicians were an important part of intelligence organizations at least as early as the sixteenth century.

▷ Precursors of all major intelligence organizations were the activities carried on by merchants, vendors, and lending houses.

▷ Modern technology has revolutionized intelligence data collection and processing; however, the man in the system is as critical as ever because only he can derive meaning from the data.

CHAPTER III.
INACCESSIBLE AND QUESTIONABLE INFORMATION: THE NEED FOR INTELLIGENCE

. . . A great part of the information obtained in war is contradictory, a greater part is false, and by far the greatest part somewhat doubtful.

Karl von Clausewitz

The winter of 1943-44 was especially severe for the U.S. Fifth Army and the British Eighth Army in Italy. The northward advance of the Allied forces was halted by a stubborn force of Axis defenders at the Gustave Line, a line of fortifications built on the commanding terrain overlooking the Rapido River and the Liri Valley and anchored on the left flank by a monastery on Monte Cassino. This monastery, it was felt, was the key defensive position of the entire line. According to best opinions at the time, the monastery provided excellent cover for German artillery observers who had an unobstructed view of Allied forces dug in on the valley floor. Destroying the monastery became more than a military objective: it soon became an obsession with every Allied commander whose casualties mounted daily as a result of enemy action and weather.

Conventional methods failed to destroy what was perceived to be the key enemy stronghold. Artillery had little apparent effect on the massive stone masonry, and tactical bombing was equally ineffectual. The key to destroying the bastion was information–information about the construction details of the monastery-because only on the basis of this information could the optimum size and nature of the destructive devices to be used against the monastery be determined. But who had this information? Where was it located? How could it be obtained?

Exhausting all intelligence staff resources available at division and corps, Major General F.I.S. Tuker, Commanding Officer of the 4th Indian Division, took matters into his own hands. He drove to Naples, combed book stores until he found an old book relating to the monastery, and located precisely the information he needed. On the basis of this information, appropriate weaponry was designed, and the monastery was destroyed.[1]

The key to the destruction of this military objective was *intelligence*—collected, evaluated, and interpreted information significant to military planning and operations.

Numerous lessons could be derived from the incident related above; for example: the necessity of an intelligence staff to perform its assigned functions, or the importance of basic intelligence in military operational planning. But the feature of the incident that is most relevant to this text is the activity that General Tuker performed, namely, intelligence research. General Tuker perceived an operational situation in terms of a problem to solve, delineated his research objectives, considered likely sources of information, located the information, evaluated it, and made it available to ultimate users.

This chapter discusses the purpose for which intelligence is produced, the conventional forms and components of strategic intelligence, and the organizations whose intelligence research activities address the various components of strategic intelligence.

Purpose of Intelligence

Intelligence is evaluated information. It is produced to help policy makers and planners make effective decisions. For the greater part, strategic intelligence—that intelligence required for use at the national and international level—is used for strategic *planning.*

[1]Fred Majdalany, *Cassino: Portrait of a Battle* (London: Longmans, Green and Co., Ltd., 1957), p. 114. Ironically, after the Gustave Line had fallen, it was learned that the Germans had *not* used the monastery as an observation post.

Strategic planning involves establishing courses of action, usually long-range courses of action. A course of action could relate to a military activity, but it could also relate to a political or economic activity or to a combination of military and political activities such as the recognition of a new head of state, an embargo, boycott, or blockade. Strategic planning may address existing problems or conditions, or anticipated or hypothetical problems and conditions. In the latter cases, the strategic planning would be called contingency planning.

Strategic planning, like all planning, must be based on information. However, information required for strategic planning is often inaccessible because other countries' military or political groups realize the importance that certain types of information may have for others who may be real or potential enemies. Consequently, these countries take extensive measures to deny, limit, or falsify certain types of information and data. Thus, in addition to the methodological problems of obtaining and utilizing information commonly encountered by most planners, strategic planners encounter the very significant problem of obtaining information that others wish to deny to outsiders.

This act of denying certain information to others is what has given rise to intelligence organizations. Without the denial or inaccessibility of certain types of information, intelligence organizations would be unnecessary since information required for strategic planning would be available from other governmental agencies or from the countries or foreign groups directly.

Not only has the denial of information to others given rise to large intelligence organizations and activities, but it has also determined the nature of the operations performed by intelligence organizations. For example, intelligence organizations must employ an array of data collection procedures and devices ranging from sophisticated sensors to human observers.

In addition to the necessity for using an extensive array of collection systems, intelligence organizations must spend much time and effort assessing the quality of their data. No estimate

or projection is any more reliable than the input upon which it is based; consequently, establishing the reliability of data is one of the main functions of any intelligence organization.

Another characteristic function of intelligence organizations that evolved because certain types of information are denied is the necessity to use inferences when facts are unavailable. Major intelligence analyses or research projects are devoted to the systematic establishment of strong inferences, to the testing of these inferences, and to the gradual substitution of strong inferences (and, ideally, facts) for initial tenuous inferences and guesses. It is this last characteristic that sets intelligence apart from many other types of information-gathering activities, and it is the topic that this text addresses throughout.

Forms and Components of Strategic Intelligence: Opportunities for Research

Strategic intelligence encompasses eight major subject matter areas and requires the application of knowledge and skills of dozens of academic disciplines ranging from information science and data processing to anthropology and political science.

There are many ways of classifying intelligence and its related activities. However, for the purpose of this text, intelligence—the *product* resulting from the collection, evaluation, analysis, integration, and interpretation of information concerning a foreign nation or an area of operations—will be classified according to two criteria: 1) the basic purpose for which it is produced, i.e., its form; and 2) the subject matter addressed. These basic forms and subject areas of strategic intelligence are described briefly below in order to emphasize the range of potential types of research that may be required to support strategic intelligence production.

Basic forms of intelligence and the purposes for which they are produced

On the basis of the first criterion, intelligence may be produced to enhance the existing body of knowledge about a country. This type of intelligence is encyclopedic in nature. It is

produced partly in anticipation of kinds of information that would be required should a conflict break out involving a given country. It is also produced in order to permit better interpretations of current activities to be made. This kind of intelligence is referred to as *basic intelligence.* The name is most appropriate. Basic intelligence invariably constitutes the bases for deriving meaning from other types of intelligence.

Basic intelligence—its collection and analysis activities—is the least spectacular of all types of intelligence operations; but nevertheless, this type of intelligence is most essential. It is difficult to imagine how the Normandy landings in World War II could have been conducted without knowledge of the landing beaches—their gradients, load-carrying capabilities, tides, natural and manmade obstacles. Basic intelligence is oriented around past *and* present conditions and events. Perhaps the most familiar documents containing basic intelligence are the *National Intelligence Surveys.*

Intelligence is also produced to keep track of events occurring in various parts of the world which would impact on U.S. policies and national interests. This type of intelligence is called *current intelligence.* It is characterized by change—aptly enough—and requires the constant updating of earlier conclusions, analyses, and judgments. When events occur rapidly, this type of intelligence gives rise to intense activity.

Surprises are anathemas to any intelligence organization, and one of the fundamental reasons for having intelligence organizations is to reduce the likelihood that any foreign power could commit an act, develop a capability, or establish a relationship that was unanticipated. Thus, in a further attempt to reduce surprise, a third type of intelligence has evolved—*estimative/predictive intelligence.* This type of intelligence addresses the likelihood of a country's engaging in a certain type of activity in the immediate or forseeable future. Ideally, this type of intelligence attempts to establish the intent of decision makers in foreign countries. More realistically, estimative/predictive intelligence attempts to anticipate future actions based on current capabilities. Although it is concerned with

prognostication, estimative/prodictive intelligence is founded on descriptions of current realities.

Evaluation is addressed in all three types of intelligence. Quite literally, evaluation is involved in the determination of the actual costs of the other side's war making machinery, a task that is normally the purview of basic intelligence.[2] Evaluation might also relate to estimative/predictive functions. An example of evaluation used for predictive purposes would be determining the enemy's cost/benefit ratios of alternative methods for addressing a scientific or technical problem and then predicting the likely course of action on the basis of the approach which would provide the greatest payoff for the minimum risk. Implicit in this evaluation would be the assumption (or the prediction) that the other side would elect to follow the more "rational" approach.[3]

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[2] *Appraise* would be a more precise term to use since it connotes the fixing of monetary worth.

[3] Many predictions in intelligence are based on the assumption that the other side is "rational"; and rationality is usually defined in terms of the value system of the person making the judgment. This gives rise to problems when it fails to consider that value systems may differ considerably. The assumption of a "rational" enemy also fails to account for behaviors such as Hitler's "emotional" and fatal decision to bomb urban areas during the Battle for Britain rather than to continue to eliminate the British early warning systems; or Hitler's decision to sacrifice Paulus's Sixth Army at Stalingrad rather than yield any conquered territory. Surprise in warfare is often possible because it seemingly violates the canons of rationality. "Irrational" risks are undertaken when the potential payoff is high; hence, the Japanese attack on Pearl Harbor, and the Soviet Union's placement of missiles in Cuba. Given no knowledge to the contrary, the hypothesis that the "other side" is rational by one's own values is nevertheless a plausible and practical starting point. This will be discussed further in later chapters.

With respect to tenuousness of conclusions and obsolescence of products, estimative/predictive intelligence ranks highest in the potential for mistakes. Estimative/predictive intelligence is oriented around present *and* future conditions, activities, and events.

Components of strategic intelligence

In addition to being classified by function and time orientation, intelligence can also be classified according to subject matter addressed. These categories of intelligence subject matter are also known as the "components of strategic intelligence." The components include the following:

Biographic Intelligence
Economic Intelligence
Sociological Intelligence
Transportation and Telecommunications Intelligence
Military Geographic Intelligence
Armed Forces Intelligence
Political Intelligence
Scientific and Technical Intelligence

Very briefly, Biographic Intelligence involves collecting and evaluating information relating to key personalities in foreign countries. Economic Intelligence considers resources and capabilities for production, economic vulnerabilities, and the availability of strategic commodities. Sociological Intelligence is concerned with social stratification, value systems, traditions, beliefs, and other social characteristics of selected populations. Transportation and Telecommunications Intelligence examines transportation networks (highways, railroads, inland waterways, civil air) as well as telephone, telegraph, and civil broadcast capabilities. Geographic Intelligence studies landforms, weather and climate, coasts and landing beaches. Armed Forces Intelligence addresses orders of battle, equipment, doctrine, and logistic capabilities. Political Intelligence examines governmental structures, national policy, and political dynamics. Scientific and Technical Intelligence is concerned with assessing

the scientific and technical capability of a country for achieving national goals.[4]

As any student of intelligence will point out quickly, the classification of types or categories of intelligence is arbitrary and incomplete. For example, Indications and Warning Intelligence is subsumed under current intelligence; and combat, tactical, and operational intelligence are excluded entirely in this classification. The various "INT's" of intelligence—SIGINT, ELINT, PHOTINT, HUMINT, and so on—are not addressed specifically in this breakdown of types of intelligence, but obviously, their outputs contribute to all components and to all forms of intelligence.[5]

It should be noted that each *component* of strategic intelligence is concerned with each of the three *forms* of intelligence. In Biographic Intelligence, for example, an individual who shows promise of rising to positions of authority would be a subject pertinent to estimative/predictive intelligence analysis and research. Individuals currently in power or currently occupying leadership positions would be addressed by current intelligence analysts. And individuals who formerly held high positions but who were replaced, abdicated, resigned, or died, become the subjects of basic intelligence research or analysis. In short, even "static" subject matter becomes seemingly "dynamic" in strategic intelligence production.

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[4]For a more detailed description of the components of strategic intelligence, the reader should consult *Introduction to the Components of Strategic Intelligence* (Washington, D.C.: Defense Intelligence School, 1972).

[5]To confuse matters further, some intelligence organizations are organized on a geographical basis, e.g., China/Asia Division, Western Area Division; or on an analytical function versus an operational function basis; or on a foreign intelligence, domestic counter-intelligence basis, and so on.

Within the total framework of forms and components of strategic intelligence, two basic functions of intelligence are evident: 1) to explain, account for, or describe a phenomenon; and 2) to predict, forecast, or estimate.[6] These two functions will be recurring themes throughout the rest of this text.

Research Within the Intelligence Community

Clearly, the scope of strategic intelligence collection and production exceeds the capabilities of any one organization. Furthermore, not all government organizations are equally concerned with, nor are they the primary consumers of, all categories of intelligence. It is not surprising, therefore, that the State Department would be more concerned about Political and Sociological Intelligence than would the Department of Defense. Conversely, intelligence directly relevant to military operations–Armed Forces Intelligence, Military Geographic Intelligence, and Transportation and Telecommunications Intelligence–would be of greater concern to the Department of Defense and, more specifically, to the Defense Intelligence Agency (DIA) and to the intelligence organizations of the various services, than to either the Central Intelligence Agency (CIA) or to the State Department. Scientific and Technical

[6]Estimation addresses two types of problems. For example, an analyst might be assigned the task of estimating the size of an enemy garrison. In this case the enemy garrison comprises a finite number of personnel at any specific time which, theoretically, could be counted. On the other hand, an agricultural economist might be assigned the task of estimating the size of the Soviet Union's wheat crop–a crop that would not be ready for harvest for months to come. This type of estimation involves more than counting. It requires the analysis of those variables that would affect the crop (precipitation, temperature), and the determination of the effects of these variables; hence, it involves prognostication. The first type of estimation is essentially description. The second type of estimation involves an element of prediction.

Intelligence would be of special interest to DIA *and* CIA because of the potential threat implications of new tactical and strategic weaponry, but this type of intelligence would not be a major concern of the State Department.

Production responsibilities of the various components of strategic intelligence are shown below. Table III-1 denotes the primary responsibility of an intelligence community member: it does not imply that other members of the community may not produce that type of intelligence. In instances in which current intelligence requirements dictate the necessity of one agency's producing intelligence which would nominally be the responsibility of another agency, permissive responsibility for production may be granted to that agency.

The intent of this brief description is not to teach the organization of the U.S. intelligence community, but rather to indicate in which agency certain types of intelligence research functions would most likely be performed. The agency responsible for producing a certain kind of intelligence can be expected to have the greatest amount of reference materials, sources and resources relating to that particular topic area.

But there is a danger in thinking that certain types of intelligence are necessarily the purview of one organization and not another. For example, in stability-type operations, the U.S. Army would be both a producer and consumer of Biographic Intelligence, Political, and Sociological Intelligence. And in psychological operations (PSYOP), for example, Sociological Intelligence might be produced and consumed by *joint* State Department and U.S. Army teams. An example of the latter was the Joint U.S. Public Affairs Office (JUSPAO) in Saigon which, along with MACJ3-11 of the U.S. Military Assistance Command in Vietnam (MACV), coordinated and conducted PSYOP activities throughout Vietnam. JUSPAO and MACJ3-11 utilized Biographic Intelligence, Political, Sociological and Telecommunications Intelligence in its day-to-day operations.

In World War II, the paper "Tenth Fleet" of the U.S. Navy produced and utilized Political and Sociological Intelligence on

Table III-1. Intelligence Organizations and their Primary Production Responsibility

COMPONENT OF STRATEGIC INTELLIGENCE	PRIMARY RESPONSIBLE AGENCY
BIOGRAPHIC	DIA (MILITARY)* CIA (OTHERS)
ECONOMIC	STATE DEPARTMENT (FREE WORLD) CIA (COMMUNIST COUNTRIES)
SOCIOLOGICAL	STATE
TRANSPORTATION/TELECOMMUNICA-TIONS	DIA
MILITARY GEOGRAPHIC	DIA
ARMED FORCES	DIA
POLITICAL	STATE
SCIENTIFIC/TECHNICAL	DIA (AND VARIUS S&T ORGANIZA-TIONS OF THE DIFFERENT SERVICES) CIA

*AS OF OCTOBER 1974, THE NATIONAL SECURITY AGENCY (NSA) WOULD ADDRESS ALL COMPONENTS AS OPPORTUNITIES EXISTED.

internal conditions in Germany as well as current tactical intelligence on German U-boat dispositions. And U.S. Navy personnel, notably Rear Admiral Ellis M. Zacharias, used his knowledge of social customs, traditions, and key personalities of Japan effectively in the conduct of propaganda campaigns from the Office of War Information (OWI). Again, the situation and policy dictate the manner in which a single agency or a combination of agencies will address an intelligence problem.

Summary

▷ Intelligence, collected and evaluated information about a foreign country or an area of operations, is essential for strategic planning.

▷ That many countries deny certain information to outsiders makes intelligence organizations and activities necessary.

▷ The denial of information determines both the nature of the activities conducted by intelligence organizations, and the nature of the products these organizations produce.

▷ Strategic Intelligence can be classified on the basis of the various forms of intelligence as well as by the subject matter addressed in the various forms.

- Forms of intelligence include basic intelligence, current intelligence, and estimative/predictive intelligence.
- Components of strategic intelligence, i.e., the subject matter areas addressed, include Biographic, Economic, Sociological, Transportation and Telecommunications, Military Geographic, Armed Forces, Political, and Scientific and Technical Intelligence.

▷ Various agencies of the intelligence community have different primary responsibilities for intelligence production. These agencies are also the primary repositories of information relating to their areas of responsibility.

CHAPTER IV.
RESEARCH: A DESCRIPTION OF THE ACTIVITY

> *. . . The idea that the object of research is new knowledge does not seem to be widely understood and 'a schoolboy looking up the meaning of a word in the dictionary is now said to be doing 'research.' Indeed, it has been debased even further. Research is frequently used to describe reading by those to whom reading, apparently, is a recherche activity, and for many a graduate student it is a euphemism for wholesale plagiarism. The work needs a rest or at least less promiscuous handling.*
>
> Bergen Evans and Cornelia Evans

Many activities referred to as "research" do not satisfy the requirements of the term. This chapter describes briefly the various interpretations of the term, and sets forth three criteria that must be satisfied in order for an activity to qualify as research.

Original Meaning and Modern Permutations

"Research" (or re-search) evolved from the French verb *recherche* which, strictly speaking, means to search again, or to explore something that has already been explored. The activities of Copernicus and Tycho Brahe would qualify well as examples of research in the original sense of the word. Both astronomers examined their recorded observations of the movements of heavenly bodies time and time again. Their contributions to the science of astronomy were significant not so much for the addition of new facts but for their better interpretations of the then-existing information.

Today, the generally accepted meaning of the word "research" is diligent and systematic inquiry into a subject to

discover new information or principles. Admittedly, if the formulation of principles were the only criterion, very few "diligent and systematic inquiries" would qualify as research. More commonly, research involves the formulation and testing of hypotheses, those precursors of the more elusive theories, principles, or natural laws.

From the standpoint of semantics, the word "research" should be defined rigorously and its use restricted or it should be stricken from the English vocabulary. Denotatively, the meaning of the original term is quite explicit: namely, to search again, to explore something that has already been explored. Connotatively, however, "research" means much more. A cursory examination of the titles of theses submitted by candidates for advanced degrees reveals that activities involving experimentation, surveys, examination of historical documents, development of techniques and algorithms, unusual applications of established methodologies, testing of materials, and the creation of artistic works, have all qualified as "research"—qualified in the sense of satisfying the requirements for an advanced degree.

On a typical university campus one can expect to find as many different interpretations of what constitutes research as there are academic disciplines represented in the sample of respondents. And the person performing research in intelligence is very likely to encounter researchers to whom any investigation outside of their own particular specialities would not warrant the title of research. Hence, the physical scientist (and many behavioral scientists) would perceive research as an activity involving some sort of an experiment; a historian might perceive research as an activity involving an intensive examination of records of events; an analytical philosopher might perceive research in terms of a critical examination of the meaning of terminology used in philosophic discourse; and an engineer could perceive research in terms of submitting various materials or structures to tests.

Not only is the term "research" used to encompass a wide range of activities pertaining to an even wider range of subject

matter areas, but it is sometimes also used to add a degree of respectability to activities that otherwise would be considered trite and mundane.

Numerous attempts have been made to dictate the desired use of terminology, but generally these attempts fail. The Queen of Heart's disclaimer to Alice that "words mean whatever I want them to mean" is an apt description of most users of modern languages.

But meanings are obscured, concepts cannot be shared, and misunderstandings result with the use of words that mean different things to different people. Therefore for those investigators or students who will be faced with the requirement to perform research, an understanding of the term is most important. From a very practical standpoint, an understanding of the more precise meaning of the term will help eliminate time lost in planning and conducting an activity which would not qualify as research. This understanding will also broaden one's perspective of the wide range of activities (and products) that *do* qualify as research.

For example, the authors recall an incident in which a paper that traced the creation and evolution of a military unit was shown to a psychologist. The psychologist read the paper and commented that the paper qualified as a "piece of journalism" but hardly as an example of "research." The report, which corrected a number of misstatements that had been promulgated for years, was compiled after a lengthy and painstaking examination of hundreds of documents contained in repositories in three countries. The psychologist's comment is pertinent for two reasons: first, it revealed a bias that any type of inquiry not cast in a certain framework—in this case an experiment, the research model with which the psychologist was most familiar—was not acceptable as legitimate research. Second, by implication, the comment denigrated journalistic or reportorial research, an activity which when done well involves

extensive "systematic inquiry" and requires the same amount of attention to detail, concern about sources, objectivity, and thoroughness that should characterize all research.[1]

It should be apparent that an activity does *not* qualify as research merely because certain subject matter is addressed or because certain methodologies are employed. However, an activity may qualify as research provided three criteria are met: 1) the activity is *purposeful,* i.e., it is conducted with a specific objective in mind; 2) the activity is performed *systematically;* and 3) the activity contributes new knowledge (or new interpretations of old knowledge). These criteria warrant further discussion.

Research as a Purposeful Activity

In research, purposefulness implies the existence of an objective—a clearly identifiable, specifiable, and meaningful end in its own right which, if achieved, could be recognized not only by the researcher, but also by independent observers as well. For example, an intelligence analyst who constantly updates an order of battle (OB) is *not* performing research by this criterion since orders of battle always require updating. The updated order of battle is tentative and is only a means to some other end. A technician performing quality control tests on materials is not performing research because, again, no specific identifiable end is addressed. Testing is merely a set of procedures for maintaining a level of quality; it is not an end in itself.

On the other hand, an OB specialist *would* be performing research if he formulated hypotheses relating to a command hierarchy or the location of an unnamed unit and systematically tapped his sources to confirm or refute his hypotheses. And a quality control technician *could* be said to be performing research if he devised and tested a procedure for sampling. In

[1] Significantly, journalism is an excellent model for intelligence researchers. The time constraints under which reporters typically operate and the consequences of publishing incorrect, or incomplete information are most analogous to the intelligence researcher's constraints.

both examples, the criterion of addressing a specific, finite objective was satisfied and a clearly identifiable end product resulted.

Aims, objectives, and goals are three terms commonly associated with purpose. As they are used in this text, *aims* refer to the general intents of the investigator. Aims are manifested in the direction that an investigator's endeavors might take. *Objectives,* on the other hand, refer to clearly specifiable and identifiable *ends* of an investigation. Objectives are often stated in terms of some finite time period. *Goals* refer to those ultimate ends which, for most practical purposes, are never achieved. Thus, the aim of military planners might be to sever the enemy's lines of communication. The aim could be cast in terms of specific objectives, e.g., destroying a railroad marshalling yard, a bridge, or a critical stretch of highway within a specified period of time. The ultimate goal of these endeavors might be to bring about a lasting peace," or "to make the world safe for democracy."

In the context of intelligence research, the aim of the researcher might be to study North Korean propaganda and North Korean political or military behavior. His specific objective might be to determine whether or not any correlation existed between North Korean public announcements relating to unification and incidents along the DMZ during the period 1 January 1972 to 4 July 1972. The overall goal of the researcher might be to formulate generalizations about the words and deeds of North Korean policy makers that might be used as a basis for anticipating future behavior.

Research as a Systematic Activity

In order to qualify as research, the act of inquiry must be conducted in a systematic manner. The exact nature of the system employed, of course, would be a function of the subject matter addressed. Systematic implies that an investigation adheres to an organized and methodical order of procedures—a plan, for example. The main reason for emphasizing a systematic and orderly approach to an investigation is to ensure that

significant elements are not excluded. For example, there are certain critical steps in experiments which, if they were not addressed initially, would render later findings worthless.

Another reason for emphasizing a systematic approach is to make explicit the manner in which conclusions were reached. Systematic procedures make it possible for other researchers to replicate a study in order to determine if the findings necessarily derived from the data and not from some spurious element accidentally (or intentionally) introduced by the investigator.

One of the most devastating things that can befall a graduate student is to be informed at the time he is defending his thesis that he overlooked a significant work. Equally frightening, and potentially far more serious for the intelligence researcher, is to be in a situation of defending an estimate that overlooked significant data held by another agency. Attention to detail and an organized and orderly manner of progression throughout the research phases are ways of precluding these nightmares.

Research as an Activity that Contributes New Knowledge

The final criterion of research is that it contributes new knowledge. Ultimately, this is *the* most significant criterion and the end toward which the other two criteria contribute.

At the outset it should be made clear that new knowledge is not necessarily synonomous with new information. For example, new interpretations of old information would qualify as new knowledge in those instances in which the investigator could make a plausible case for his new assertions. (Copernicus, for example, in disproving the geocentric theory in favor of the heliocentric theory did precisely that.) Much historical research utilizes essentially no new information but instead re-examines existing information in order to formulate and test new hypotheses. Obviously, obtaining new information for generating new knowledge plays a significant part in many of today's research programs, and it is highly likely that in most

intelligence research, new information or data would have to be obtained.

Satisfying this criterion of research creates its own array of nightmares for the researcher. Every graduate student lives in fear that, unbeknownst to him, some researcher at some distant university is addressing the very same problem as he and that the other researcher might publish his findings first. Scientists on the verge of major breakthroughs are highly competitive in their desire to publish before their colleagues, as James D. Watson candidly admits,[2] and rivalry between intelligence organizations of the same country is by no means unusual, as Cookridge points out in his description of the Gehlen organization.[3]

Summary

▷ In order to qualify as research, an activity of inquiry must satisfy three criteria.

▷ The activity must be *purposeful* in the sense that it addresses an identifiable end or objective; e.g., that it attempts to answer a specific question or set of questions.

▷ The activity must be performed *systematically:* it must conform to a plan or a design.

▷ The activity must contribute *new knowledge* or new interpretations of existing knowledge.

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[2]James D. Watson, *Double Helix: Being an Account of the Discovery of the Structure of DNA* (New York: Atheneum Publishers, 1968).

[3]E. H. Cookridge, *Gehlen: Spy of the Century* (New York: Random House, 1972).

CHAPTER V.
INTELLIGENCE RESEARCH/ACADEMIC RESEARCH: SIMILARITIES AND DIFFERENCES

Many of those now engaged in intelligence production have formerly been engaged in creative scholarship at educational institutions. They find much similarity. Those who have a sincere interest in their work, high standards of scholarship, and a proper pride in the finished paper find that those values are also of great importance in intelligence work. Many intelligence workers, therefore, quite naturally overlook the fundamental difference between an intelligence paper and a scholarly paper.

Washington Platt

The layman typically associates research with universities. But obviously research is conducted in many non-university settings as well, for example, in industry, in private institutions, and of course, in numerous governmental agencies. Despite the varieties of activities performed under the rubric of research, despite the subject matter addressed, and despite the organization sponsoring the activity, the basic concept of research that persists is the academic model—academic in the sense that the activity conforms to certain scholastic traditions or rules. Academic research must be purposeful, systematic, and contribute new knowledge. But in addition, the activity or the product should exemplify reasoning ability, judgment, intellectual honesty, and objectivity on the part of the individual performing the activities.

Although the canons of academic research still constitute the underlying model for intelligence research, often the canons cannot be satisfied. Thus, in many respects, intelligence research may be the antithesis of academic research. This chapter tells why.

Time Constraints

With the possible exception of journalists, no professionals work under the constant press of time constraints so much as intelligence analysts or researchers. Admittedly, the graduate student anticipating a June graduation works under a kind of time constraint, and a researcher—Watson, for example—who wants to cop a Nobel Prize works under a competitive time constraint; but these constraints are artificial in the sense that survival is seldom at stake. With respect to urgency, perhaps the closest analogy to intelligence research would be medical research directed toward developing immunization for a particularly virulent disease that was decimating a population.

Time constraints ultimately affect other characteristics of intelligence research as well; for example, the intelligence researcher may not have enough time to collect all of the information that he felt was essential to arrive at a conclusion, or he may not have the time to corroborate or establish the validity of his input and, consequently, must qualify his conclusions. It should be noted that the individual with a penchant for an unhurried and exhaustive analysis of his research problem may find that he is exceedingly unhappy and frustrated by the necessity to produce estimates long before he is satisfied with his input or with his analysis. As the nature of conflict changes, the intelligence researcher may find that the tempo of his activities changes accordingly. Time constraints may induce an intolerable level of stress. Admittedly, some individuals not only adapt to the necessity of producing under stress, but also seem to thrive in this kind of environment. Other individuals whose perception of research was limited to the "academic" model may never learn to adapt and eventually drop out of (or are dropped from) the profession.

Control of Variables

Much academic research involves experimentation. An experiment is essentially a set of procedures used to test an hypothesis. The experimental ideal is a situation in which the independent variables can be manipulated and controlled in such a manner that the dependent variable follows

unambiguously and irrefutably. The outcome of the experiment is determined by the design and by the controls imposed by the design. These conditions can be created and controlled fairly well in the laboratory: in the field, however, experimental controls are rarely possible. Many social scientists (and inexperienced intelligence researchers) are dismayed when they discover that the experimental ideal they addressed so effectively in the university setting is so elusive in the field that it tends to be nearly irrelevant in application. Again, many researchers learn to adapt, to be pragmatic, to alter and modify their approaches to accommodate the constraints imposed on their research activities. Other researchers feel that adaptation is tantamount to compromising standards and consequently refuse to work in this type of environment regardless of the fact that decisions must still be made and the decisions will be made with or without the knowledge that even a "compromised" experimental design might yield.[1]

In intelligence research, the researcher has virtually no control of the variables other than the methods he employs himself. The enemy, or the "other side," is notably uncooperative. The enemy may refuse to respond to a "stimulus" (for example, a propaganda message), he may deliberately alter his mode of behavior in a manner to avoid any indication of pattern, he may change his response modes constantly in order to preclude anyone's anticipating a future action. In short, and in the language of the social scientist, the other side is a notoriously poor subject; yet he is the subject of inquiry to the intelligence researcher.

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[1] For a more complete discussion of the constraints placed on social research in a field situation see Ernest F. Bairdain and Edith M. Bairdain, *Final Technical Report, Psychological Operations Studies—Vietnam*, vol. 1 (McLean, Virginia: Human Sciences Research Inc., May, 1971).

Adequacy of Data Versus the Necessity to Report

Incompleteness is a feature that characterizes nearly every intelligence product. Sometimes an assessment or a prediction is incomplete because no data exist. Data may not exist because the other side may not have manifested any observables.[2] More often, an intelligence product is incomplete because the enemy does a good job of denying certain kinds of information to outsiders. It is this type of situation that the intelligence researcher is most likely to encounter. In both instances, however, the intelligence researcher is required to arrive at conclusions–conclusions which may have profound implications for national security–but conclusions which are founded on theories, assumptions, and sometimes simply guesses when data or information are not available.

Unlike academic research in which the researcher may delay publishing his findings until he or his advisers are satisfied that the findings are adequate to justify his conclusions, the intelligence researcher may not have time to collect additional data, or the political or military situation may have changed so much that additional data could not be collected even if time were available. Again, this condition induces much frustration in those to whom the academic model of research is inviolable.

Unknown Quality of Data

The academic researcher attempts to use data of the highest quality. He checks sources, corroborates information, excludes information from notably unreliable sources, and withholds publication until he is satisfied that his conclusions are founded upon irrefutable evidence. The intelligence researcher attempts to emulate his academic counterpart but often encounters situations in which the *only* data available are data from sources whose reliability has not been established. Furthermore, the intelligence researcher sometimes encounters data that have

[2]To put it another way, the other side may take a "wait and see" stance and, thus, not react to a situation in any overt manner.

been prepared deliberately to deceive or to mislead.[3] Admittedly, the academic researcher encounters these situations at times, for example, the spurious "Donation of Constantine" and the "Piltdown Man," but these exceptions are so rare as to be noteworthy perversions in their own right. In certain types of intelligence research activities, on the other hand, these noteworthy exceptions tend to be the common rule. Again, the intelligence researcher is required to publish despite his lack of confidence in the data simply because in many instances operational decisions cannot be deferred until more or better information is available.

Emphasis on Prediction

Of all the intellectual activities performed by man, none is so fraught with potential for error as prediction. Yet prediction (in its various forms) constitutes a major part of the activities in intelligence, and is, in fact, the purpose for which even basic intelligence is produced (fore-knowledge). Prediction, for the greater part, is based upon observed regularities. For example, a certain combination of meteorological phenomena invariably results in another predictable type of phenomenon. Natural laws are essentially predictive statements which take into account the interaction of regularly occurring phenomena.[4]

The problem of prediction in intelligence is exacerbated by two conditions: first, unlike most naturally occurring phenomena, humans have the ability to alter and control certain conditions and interactions. A cautious enemy, for example, will avoid repetitive acts which would permit his opponent to anticipate his future behavior; or the enemy may deliberately

[3]See, for example, Ladislav Bittman, *The Deception Game: Czechoslovak Intelligence in Soviet Political Warfare* (Syracuse, New York: Syracuse University Research Corporation, 1972).

[4]Interestingly, the science of astronomy evolved from the necessity of priests to be able to predict movements of heavenly bodies. The ability to predict enabled the priests to exercise power, and today the relationship of predictive ability and power still holds.

maintain one pattern in order to conceal another type of behavior. As such the intelligence researcher may be uncertain as to how much credibility he can assign to an observed behavior.

The second condition that gives rise to difficulties in prediction are unique events–events which have no precedent. Examples of such events might be the appearance of a new RF signal in an area in which all signals had been accounted for; or the enemy's construction of a peculiar type of structure whose purpose cannot be determined from its shape or size. Although procedures exist for dealing with unique events, such as the generation of alternative scenarios and gaming, for example, none of the procedures has the predictive power for a researcher to state unequivocally that, given conditions "X" and "Y," "Z" will result *invariably*. Yet this is the kind of assertion that policy makers seek from intelligence organizations. Much has been said about the weighty responsibility of the decision maker, but little attention has been paid to the person who makes the predictions upon which decisions are made. How many people, for example, recall the name of the meteorologist who predicted clearing weather prior to the Normandy invasion?[5]

Lest the picture be painted too bleakly for intelligence research, it should be noted that an increasing amount of "academic" research is also addressing predictive–type problems, for example: predicting volumes of vehicular traffic in urban planning, predicting mineral yields, predicting the effects of population on ground water quality and consumption, predicting economic impact of new industry in a region, and so on. In addition, courses on "futurology" are becoming increasingly common on campuses throughout the country. "Futurology," as the name implies, is the study of future conditions based on current and anticipated trends. In 1974

[5]RAF Group Captain J. N. Stagg gave the final meteorological report and prediction to General Eisenhower and his staff prior to D-Day.

some 200 courses in various related areas of "futurology" were offered at 140 institutions, compared to a single course offering in 1966.[6]

Sources of Information

Anyone who is even remotely familiar with national intelligence organizations realizes that these organizations have means of obtaining information that are unavailable to the general public. The ability to obtain certain kinds of information by use of the more esoteric collection devices have made obsolete some of the traditional methods of research. For example, in certain instances in the past, analysts and researchers had to guess the number of enemy surface units or aircraft whereas today in many cases they have the capability of actually counting them. The ability of the intelligence researcher to draw upon the information yielded by these more esoteric collection devices gives him a clear-cut advantage over the researcher who is constrained to use more conventional methods of data collection. Perhaps the biggest change that has resulted from the use of newer collection devices is the confidence that can be placed in the results of the analyses. Research procedures, *per se,* may remain essentially unchanged, but given "harder" data, the researcher is in a much stronger position to draw conclusions.

The intelligence researcher also has access to inter-agency libraries and reference services that rarely would be available to the student or academician. In terms of the size of the U.S. Government's holdings to which he has access and in terms of the automated retrieval systems at his disposal, the intelligence researcher is in a far more advantageous position to conduct research than his academic counterpart.

Emphasis on Security

To a real or potential enemy, the awareness that the other side is attending to certain conditions or events within his

[6]Kathy Nagurny, "When is Man Going to Learn from the Future?", *The Philadelphia Inquirer,* 1 December 1974.

country provides a tactical advantage. Consequently, intelligence organizations avoid advertising what they are examining and how they are going about doing it. This security is essential to safeguard human and other sources of information as well as to avoid embarrassment at diplomatic levels. To the analyst or researcher, the result of this emphasis on security is anonymity. This usually means that the analyst may not discuss his activities with his academic counterparts, and that the product of his efforts will not be attributed to him personally.[7] Many researchers whose psychic rewards come in the form of papers published in professional journals find that the enforced anonymity is intolerable. Other researchers, of course, learn to accept this condition.

Again, the picture is not all bleak for those who desire to perform both academic and intelligence research because there are many types of intelligence research activities that need not be classified and probably will not be classified in the future.

Secrecy in intelligence will always exist. But changes are occurring rapidly, and activities that were formerly classified (or not acknowledged) are now openly admitted. It would take an extremely naive individual, for example, to assume that the Soviet Union or the People's Republic of China were not primary concerns of U.S. intelligence organizations.

Utility

To the question, "Why do you climb mountains?" George Leigh-Mallory responded, "Because it is there." Poetic perhaps, and provocative, this response would not suffice should an intelligence researcher be asked why he was "researching" a certain topic. Although all research is purposeful in the sense that it attempts to provide new knowledge, intelligence research must address a utility goal as well. In other words, it must assist in solving a problem—most likely, a decision-making or policy planning problem.

[7]There may be changes to this policy. DIA is considering the use of by-lines on certain reports.

Because intelligence research serves utilitarian purposes does not mean that "scholarly" research has no place in intelligence. The criterion of utility says nothing about the subject matter of the research nor anything about the research methodology. The utility criterion simply means that the product of the research must address either an existing need or a plausible potential need: in short, intelligence research must yield more than "truth for truth's sake."

At times the precise manner in which a research product will be (or could be) used may be difficult to predict. For example, in 1965, Dr. William Stockton (an anthropologist and a former student at the Defense Intelligence School), along with three other investigators, prepared a report dealing with indigenous tribes of the Republic of Vietnam.[8] Although the overall relevancy of such a work was apparent even in 1965, little did the authors realize that the sections of the report relating to burial habits would be extremely useful nine years later when attempts would be made to ascertain the fate of downed U.S. airmen. Interestingly, Dr. Stockton also participated in this latter activity as well.

A seemingly "academic" research project such as determining precedents (if any) of the Russians' use of massed artillery (as in World War II) may well provide a basis for anticipating Soviet artillery doctrine in future conflicts. And an exhaustive examination of France's employment of static defenses, such as the Maginot Line and the fortresses of Dien Bien Phu, might reveal subtleties in French military doctrine that would not be apparent at a superficial level.[9] Current

[8]Joann L. Schrock *et al., Minority Groups in the Republic of Vietnam* (Washington, D.C.: Cultural Information Analysis Center, Center for Research in Social Systems of the American University, 1966.)

[9]Ironically, the fall of Dien Bien Phu and the subsequent decline of French influence in Indo-China was brought about largely by the Viet Minh's employment of massed artillery. The French defenders of Dien Bien Phu ruled out the likelihood that the Viet Minh would or could use artillery because of the mountainous terrain and the absence of roads, a classic example of an intelligence failure.

conflicts between the Soviet Union and the People's Republic of China had precedents as early as the thirteenth century when the Mongol hordes sacked Russian settlements in the Donetz basin. An analysis of these early conflicts may throw some light on the present Sino-Soviet conflict.

Research topics evolve from perceived needs of the operational situation, and many times topics for investigation will be assigned to the researcher rather than chosen by him, as will be discussed later. But the intelligence researcher who is thoroughly familiar with a body of subject matter is in an excellent position to anticipate research requirements, and in these instances the researcher can often define and select his own research topics.

Briefly then, because a research topic does not have any *immediate* utility should not necessarily discourage an intelligence researcher from pursuing it. It is the potential usefulness as well as the immediate usefulness of the product that establish its worthiness as a suitable topic for research in intelligence, as evidenced by the large amounts of basic information contained in the old *National Intelligence Estimates.*

Summary

▷ Intelligence research attempts to emulate the academic model of research in the sense that it is (or should be) purposeful, systematic, and it provides new knowledge.

▷ Unlike academic research, intelligence research is constrained by limited time, little or no control over experimental variables, insufficient data, and the necessity to use data of unknown quality at times.

▷ Apart from constraints, intelligence research differs from academic research in four other respects as well:

- Much emphasis is placed upon prediction in intelligence research, whereas description and interpretation predominate in academic research.

- Intelligence research uses means of collecting data that eclipse the capabilities of any university or private institution.
- Unlike academic research findings, intelligence research findings are usually classified.
- The product of intelligence research must address an actual or potential problem: it must yield more than truth for truth's sake.

▷ Because the academic model of research can only be approximated at times by intelligence research does not imply that intelligence research is a less rigorous or degraded form of research. It is, however, a more pragmatic form of research than its academic counterpart.

CHAPTER VI.
CHARACTERISTICS OF THE INTELLIGENCE RESEARCHER

> *Not only are we uncertain about the strength of the enemy, but in addition rumor... exaggerates his size. The majority of people are timid by nature, and that is why they constantly exaggerate danger. All influences ... combine to give... a false impression of [the] opponent's strength, and from this arises a new source of indecision.*
>
> Karl von Clausewitz

Ask any authority to identify those human traits that are absolutely essential for anyone proposing to carry out research and four traits are mentioned invariably: reasoning ability, accuracy, intellectual honesty, and open-mindedness. Other traits that are mentioned very often include judgment, diligence, thoroughness, originality, and so on. There is no question that the possession of these traits is a *necessary* condition for producing an acceptable research product: but the possession of these traits alone is *not* a *sufficient* condition to guarantee that a research product will be acceptable. Furthermore, because of the uniqueness of intelligence research, certain additional human traits are required as well. Finally, even the more familiar traits have special implications for the intelligence researcher. These necessary (but not sufficient) traits of the intelligence researcher are discussed below.

Reasoning Ability

Invariably, any individual thinks he reasons well and that the inability of others to accept his conclusions are reflections of their inadequacies, not his. Little, Wilson, and Moore point out that:

> it is not easy to see the errors in our own thinking. Many of us are confident that our thinking is above error. But confidence is no guarantee. In fact, those who seem most confident in their thinking are usually the ones who fall into the most serious errors. Fanatics are far more confident in their conclusions than are normal people . . . . We may believe we have thought matters over thoroughly when, as a matter of fact, we have merely unconsciously accepted beliefs or conclusions from someone else and then done a bit of window dressing to convince ourselves and others that the conclusion resulted from logical procedures.[1]

Examples of the inability to reason well abound. It is not uncommon to find analysts failing to distinguish between facts and inferences or operating on the assumption that an inference was a fact. It is not unusual to hear an analyst announce that his conclusions followed "logically" from the evidence, even though generalizations arrived at inductively are not subject to logical proof. That different types of inquiry are subject to different types of "proof" is an alien concept to many researchers. And the common misuse of "infer" and "imply" reflects not only a lack of knowledge of terminology but also an unfamiliarity with underlying concepts of logic as well.

The seemingly simplistic solution of requiring the researcher to "take a course in logic" will not necessarily guarantee an improvement in his reasoning ability. But an exposure to logical fallacies, a familiarization with deductive and inductive processes, and an exposure to those subjective factors which influence thinking, should at least heighten the researcher's sensitivity to the potential for error. An exposure to logical fallacies, for example, may reveal to the researcher fallacies in his own thinking of which he was unaware. The researcher will also discover that, despite the vigor of approach, conclusions

[1] Winston W. Little, W. Harold Wilson, and W. Edgar More, *Applied Logic* (Boston: Houghton Mifflin Company, 1955), p. 1.

reached deductively are only as good as the assumptions upon which they were made; and that many decisions must be made, problems solved, and conclusions drawn in intelligence research without the benefit of validated assumptions. Finally, the researcher will discover (if he doesn't know it already) that the most difficult type of reasoning he will have to perform is induction—a type of reasoning for which hard and fast rules do not exist.[2]

Accuracy

Accuracy has two meanings. In one sense it means preciseness or exactitude. Thus, the identification of a geographic location by use of an eight-digit grid coordinate could be said to be more accurate than the same location identified by the description "about ten miles northeast of ——." Accuracy also means freedom from error, or "conformity to truth." Both interpretations are relevant to intelligence research. For example, at one time during the Korean War much confusion existed among U.S. military planners because of the failure to distinguish between the place-names, Pyongyang, Pyonggang, and Pyongan. The assignment of a target the size of a county (Pyonggang) provided little guidance for U.S. air strikes, when in fact the intended target was Pyongyang, the capital of North Korea.

Potential for error is high in intelligence research, particularly in those numerous instances in which the researcher does not work with "raw" data but instead works with data that have been pre-processed by others. For example, an analyst working with someone else's interpretation of a foreign language input is subject not only to errors that he may commit but also to errors made by the original translator. Even when working with raw data, for example, with a foreign language newspaper, the researcher may find that there are no direct

[2]A quick review of principles of logic applied to intelligence can be found in *Logic for Intelligence Analysts,* a series of four programmed instructional textbooks prepared for student analysts at the Defense Intelligence School.

English language equivalents for a word or a concept addressed and that the best he can do is to approximate the original meaning of the work; hence, the potential for error exists.

Aerial reconnaissance is highly touted as a producer of "accurate" raw data. But any intelligence researcher who has observed two photointerpreters nearly coming to blows over the issue of whether an object was a truck or a tank comes away with an uneasy sensation that the potential for error exists even when the best data collection techniques are used. Sensors do not lie, of course, but humans may lie unintentionally when preconceived notions, biases, and strong convictions interfere with perception. Unless the researcher is at least aware that he may be adding error to what is already unclear, the impact may be serious. Again the necessity for developing an awareness of subjective factors that influence behavior becomes apparent.

Necessity for accuracy exists at every stage in the intelligence cycle from collection to dissemination. An ambiguously prepared intelligence information report (IR) sets the stage for equivocal interpretations, and these in turn yield products of dubious quality. The inadvertent deletion of a zero transposes 40,000 to 4,000, perhaps with disastrous consequences.

Obviously, the potential for drawing erroneous conclusions is the most serious effect of inaccuracy in either data collection or data analysis. But the intelligence researcher who is working under severe time constraints should also recognize that correcting errors, should they be detected, is also a costly and time-consuming operation.

The fact that much of the input with which the intelligence researcher must work is of dubious quality and the fact that even presumably "hard" data may have been cunningly altered by the other side to mislead are sufficient reasons for the researcher to be all the more accurate in the operations he performs on the data—operations such as recording, counting, citing, interpreting, or quoting.

Intellectual Honesty

In the context of academic research, intellectual honesty usually relates to such things as attributing information to appropriate sources and giving recognition to others who may have contributed significantly to an effort—in short, giving credit where credit is due.

In the context of intelligence research, however, these forms of intellectual honesty may be largely irrelevant except, of course, in those instances when a research product is submitted in fulfillment of academic requirements, for example, at the Defense Intelligence School.

But the other sense of intellectual honesty—accepting information that runs contrary to prevailing opinion—is critical in intelligence research despite the fact that the analyst may be under pressure to support a particular position.[3] Furthermore, although it is easy to pay lip service to intellectual honesty, the researcher is tested severely in those instances in which his entire research effort is jeopardized by the last-minute discovery of a bit of information that would tend to refute his main thesis. It is an unusual man, indeed, who would not entertain even momentarily the idea of conveniently "losing" the unpropitious discovery. But in intelligence research, more than egos or reputations are at stake; consequently, intellectual honesty is imperative even if it means that an entire project has to be scrapped and started anew. As Barzun and Graff so aptly put it, "Elsewhere *honesty* may be the best policy, but in research it is the only one."[4]

[3]For other ramifications of this problem, see Jack Zlotnick, *National Intelligence* (Washington, D.C.: Industrial College of the Armed Forces, 1964), page 23.

[4]Jacques Barzun and Henry F. Graff, *The Modern Researcher* (New York: Harcourt, Brace & World, Inc., 1970), page 60.

Open-Mindedness

Open-mindedness relates to one's receptivity to the arguments of others. It has been stated that whereas several geese constitute a gaggle, and several cows constitute a herd, several intelligence analysts or researchers constitute an argument. Bright people often have strong egos, and researchers deeply immersed in their subject matter think (often justifiably so) that they have better insights into their problem areas than others. But this deep immersion is often the very thing that precludes the researcher from seeing the real issues. Anthropologists have discovered, for example, that it is very useful to have a "naive" observer accompany a field researcher to ensure that the trained specialist does not overlook the obvious in his concentration on the more subtle manifestations of culture.

Open-mindedness implies that one is receptive to others' opinions and interpretations—for example, alternative hypotheses which could account for a certain condition or event even though these interpretations may run contrary to one's own position. It should be noted that receptivity does *not* mean an abject acceptance of everyone's countervailing opinions. At a certain point in every research effort decisiveness is essential and a position must be taken if the effort is to be completed. But as a safeguard against committing one's self prematurely to a position that may later become untenable, it behooves the researcher to be receptive to alternatives when there is still time to take appropriate action.

Skepticism

Skepticism is absolutely essential in intelligence research. That most countries withhold certain types of information makes the information that is released all the more suspect. Experience is the best guide for the researcher for attributing credibility to a source. Certain countries' "public announcements" are so systematically misleading that a researcher can nearly always assume the opposite of what is reported. Certain types of informants believe their worth as sources of information is directly proportional to the significance of the information they provide. Consequently, their input is

exaggerated and distorted. Many would-be sources are notoriously poor observers, particularly when they purport to observe an object or an activity with which they have no familiarity.

But skepticism may work to the detriment of the researcher, and a distinction should be drawn between a "healthy" skepticism and (for a lack of a better term) an "unhealthy" skepticism. The former type of skepticism is applied situationally: the latter type is applied universally. Thus, a hardheaded skeptic would discount categorically any statement from a provincial radio broadcasting station in Hsi-ning which described problems between the People's Liberation Army and the Chinese Communist Party simply because it is uncharacteristic of communist countries to admit publicly the existence of internal problems.

In academic research, one normally assumes that his information is reliable until he finds evidence to the contrary. In intelligence research, the opposite is true, and this generalization holds as much for input from controlled sources as it does for input from uncontrolled sources.

Detachment

The intelligence researcher who becomes involved emotionally with the subject of his investigation soon loses objectivity. One of the authors noted this lack of detachment in a number of young military analysts who were examining North Korean, North Vietnamese, and Communist Chinese propaganda that was directed against the United States. Despite admonitions to the contrary, many of the young analysts were not viewing their daily "take" dispassionately, but were in fact reacting emotionally. For example, their first impulse in reading a particularly vitriolic attack against "U.S. imperialism" was to come up with counterarguments to refute the charges.

Whatever emotionalism that is generated by the researcher should take the form of enthusiasm in attacking a particularly vexing problem. Intelligence researchers should attempt to perceive their activity as a game—a serious game in which two opposing sides strive for complementary goals. One side tries to

conceal, hide, deceive, or mislead, whereas the other side attempts to penetrate the screen of ruses and stratagems in order to perceive reality. Emotionalism requires energy that should be directed elsewhere for more positive ends. In the case of the propaganda analysis just described, what was significant were not the contents of the anti-U.S. diatribes (which tended to be highly repetitive), but rather that the diatribes were being uttered in the first place and with a high degree of regularity. These facts tended to be overlooked in the analysts' emotional reaction only to the content.

It would be unrealistic to expect anyone engaged in an activity as serious as intelligence to love his enemy; but a rabid hatred of the other side interferes with one's perception and invariably destroys objectivity.

Patience, Diligence, Perseverance

Intelligence analysts and researchers who anticipate quick solutions to difficult problems are in for a rude awakening. Rarely do reports which contain succinct summaries or brilliant deductions give any indication of the amount of sheer drudgery their production entailed. Yet drudgery is more the common rule than exception in intelligence research. Dramatic solutions to intelligence problems are fairly rare events and the researcher who requires this type of positive reinforcement may soon become discouraged when he finds that solutions elude him, when he discovers that he had been proceeding up blind alleys, and when he is forced to reexamine for the hundredth time the same material with which he had been working for months.

Tycho Brahe, Kepler, and Copernicus made thousands of observations for many years before they were in a position to publish their discoveries. Darwin pondered, reflected and reexamined his findings for years and, had not another biologist been ready to announce findings similar to his, Darwin probably would have procrastinated even longer in publishing his theories

on evolution.[5] Admittedly, these examples provide little solace to the intelligence researcher working under severe time constraints. But the urgency of the problems requiring solutions makes patience, diligence, and perseverance all the more important.

Imagination

The trait that distinguishes best between the very adequate researcher and the outstanding researcher is imagination. And unlike other traits which can be acquired by training, this trait is indeed difficult for many researchers to develop. Imagination in the context of research does not refer to flights of fanciful musings, daydreams, and the like (although serendipitous spinoffs sometimes occur in this manner). Imagination in the context of research relates to releasing a kind of creative energy that provides unorthodox (but effective) approaches to problems which seemingly defy solution. Sometimes this creativity manifests itself in an ingenious approach for data collection. In other instances this creativity takes the form of assembling data in such a manner that new implications become apparent.

Margaret Mead, in discussing the problem of studying cultures at a distance (cultures to which the researcher is denied access, or cultures which no longer exist[6]), describes the importance of imagination in anthropological research:

[5]Data collection for Darwin's epochal work, *On the Origin of Species by Means of Natural Selection,* began twenty-eight years before the book was published. (*Origin of Species* also included the results of later observations, of course.) This is a classic example of an instance in which the data collection phase occurred before the problem definition phase of a research project. It is interesting to speculate whether Darwin could have published his results many years earlier had his data collection efforts on the voyage of the *Beagle* been guided by formal hypotheses.

[6]Conditions which are not uncommon to the researcher in Sociological Intelligence.

> For the study of culture at a distance, however, additional capacities are needed, because in every case the research worker who uses a particular kind of material–interviews, films, art forms, games, slang, and so on–is required to go beyond his or her source material, to delineate in terms of a larger whole, the culture, that is, the total shared, learned behavior of the members of the group or society or period being studied. In historical studies this has been called the historical imagination–the ability to reconstruct from a set of parchments, epitaphs on gravestones, lists of purchases by a steward for a manor, or of expenditures for the costumes worn in a morality play, the life of a long-past period as a whole. For such reconstruction, the student must be able to move from one set of clues to another, so that if he has a painting that shows the costumes worn in a period, a list of expenditures for stuffs, a list of the foods that were sold in the shops, a few bars of religious music, a knowledge of the climate, a calendar, he will be able to *see, hear,* and *smell* a thronged medieval street down which a Whitsunday procession passed. Only so, by fitting together separate sets of clues or traces into a reconstructed living whole, can the parts be made meaningful.[7]

Obviously, the admonition to go beyond one's source material must be heeded with discretion, and certainly no researcher is justified in making assertions that are not supported by facts. But facts alone do not constitute intelligence research. The critical question in all research is What do the facts mean? And this is where imagination plays its important role. For example, intelligence problems which cannot be solved directly are often "solved" by analogy. Yet, selecting or constructing an appropriate analogy requires

[7]Margaret Mead and Rhoda Metraux, ed., *The Study of Culture at a Distance* (Chicago: The University of Chicago Press, 1953) p. 11.

imagination. One of the techniques employed by "futurologists" and by war gamers is to construct "alternative futures." Constructing "alternative futures" is a creative act involving speculations in the form of "What would happen if . . . ?"

An outstanding example of the role that imagination can play in the practical problems of data collection in the social sciences are the "unobtrusive measures" described by Eugene J. Webb *et al.* For example, unable to measure directly the interest shown by spectators to various displays at a convention, one ingenious social scientist counted the number of nose prints on the various glass display cases. In similar applications, the researchers measured the amount of wear on floor tiles in front of various displays to determine which displays attracted the greatest number of viewers.[8] Admittedly, some of the techniques produce only "squishy" data (as opposed to "hard" data), but in many cases even "squishy" data are sufficient to permit decisions to be made.[9]

Imagination sometimes takes the form of a "hunch," that humble precursor of the more eloquent hypothesis. Washington Platt, no stranger to intelligence research, defines a "hunch" as follows:

> A scientific hunch is a unifying or clarifying idea which springs into consciousness suddenly as a solution to a problem in which we are intensely interested. In typical cases, it follows a long study but comes into consciousness at a time when we are not consciously working on the problem. A hunch springs from a wide knowledge of facts *but is essentially a leap of the imagination,* in that it goes beyond a mere necessary conclusion which any reasonable man must draw from the data at hand. It is a process of creative thought.[10]

Hunches, insights, intuitions, alternative solutions, alternative approaches, the ability to envision an ideal (e.g., a source of data, or an end product) are all manifestations of imagination which have very practical applications in intelligence research.

The intelligence researcher "cannot lay in stock" of imagination, but, as Barzun and Graff point out, he can learn techniques for releasing whatever imaginative powers he has. Constraints to imagination and creativity appear to be largely self-induced. Because of fear of error, fear of ridicule for suggesting unorthodox approaches or conclusions, and because of excessive concentration on a problem, many researchers consciously or unconsciously limit their own creativity.

Platt discovered that many successful researchers had their most creative insights just before falling asleep, or when they were engaged in some activity unrelated to their investigation, when they were listening to music, or when they were just plain relaxing; and there may be some truth to the story of Archimedes' formulating his theories of buoyancy while in the bath. But before the naive researcher sets out to create those conditions most conducive to creativity, it is important to note that, as Platt points out, "Most [researchers] reported that hunches came during periods of apparent idleness–following, however, long periods of intensive work."[11]

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[8]Eugene J. Webb *et al., Unobtrusive Measures: Nonreactive Research in The Social Sciences* (Chicago: Rand McNally & Company, 1966).

[9]Lest the reader take affront at the use of slang, "squishy" has been defined as " . . . without any well defined mathematical formulation that unambiguously captures the substantive problem." Ralph E. Strauch, in his report, *A Critical Assessment of Quantitative Methodology as a Policy Analysis Tool* (Santa Monica, California: The Rand Corporation, 1974), has given a new respectability to a term that has been used by social scientists for years.

[10]Washington Platt and Ross A. Baker, "The Relation of the Scientific 'Hunch' to Research *Journal of Chemical Education,* October, 1931, p. 1975. (Italics not in the original.)

[11]*Ibid.*

Summary

▷ Certain human traits are essential for anyone attempting to perform acceptable research: reasoning ability, accuracy, intellectual honesty, and open-mindedness. These are necessary (but not sufficient) traits for any researcher.

▷ For the intelligence researcher, additional traits are required. These additional traits include: skepticism, a sense of detachment, patience, diligence, perseverance, and imagination.

▷ Imagination is especially necessary in intelligence research in order to develop innovative techniques for collecting and analyzing data that the other side wishes to deny to outsiders. Imagination is also necessary for generating various alternative hypotheses or theories to account for conditions or events—hypotheses which could be tested at a later date.

CHAPTER VII. TYPES OF INQUIRY AND THE NATURE OF PROOF

What is now proved was once only imagined.

William Blake

Under a cover of low, thick clouds, a carrier strike force in the North Pacific launched an air strike consisting of bombers, torpedo planes, and fighters. The destination was Pearl Harbor; the objective, units of the U.S. Pacific Fleet. The approach to Oahu was completely undetected, and the result of the air strike was the theoretical destruction of the whole Pacific Fleet. The destruction was theoretical because the air strike was part of a U.S. naval war game conducted (ironically) Sunday, February 7, 1932. The activity was a simulation. It was a representation, or a *model*, of a genuine attack that could occur in the future.

Some years after the exercise, General Billy Mitchell, one of the observers of the game and a man noted for his outspokenness, said:

> If the President [Roosevelt] can be made to see that the trouble will start with Japan, perhaps we'll have more planes in the Philippines and Hawaii. For years he's had the idea that a war in the Far East would be impracticable and that an attack upon us by Japan is inconceivable. That's Navy thinking. The Japanese will not politely declare war. Hawaii, for instance, is vulnerable from the sky. It is wide open to Japan . . . and Hawaii is swarming with Japanese spies. As I have said before, that's where the blow will be struck--on a fine, quiet Sunday morning.[1]

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[1]Quoted by Emile Gauvreau in *The Wild Blue Yonder* (New York: E. P. Dutton & Co., 1944), pp. 169-171.

The prediction (or better, *prophecy*) made by General Mitchell was founded on inspiration, judgment, and imagination. His prophecy was not a prediction in the scientific sense of the term because it was not based on observations of recurring phenomena. Many "predictions" in intelligence, of necessity, cannot be made on the basis of recurring phenomena simply because the phenomena of greatest concern are those which have not yet occurred, or, if they would occur, would not be repeated. The most obvious example, of course, would be a nuclear attack by one of the major powers against the other.

This chapter is about descriptive and predictive research because these two kinds of activities constitute the major portion of intelligence research and analysis activities.

This chapter will discuss how the nature of proof differs between descriptive and predictive research. It will be shown, for example, that much of the research which purports to be predictive is really a variation of descriptive research. This chapter will also discuss models—of which the Naval war game conducted in 1932 was an example—and will show the relevancy of model validation to intelligence research, and particularly to predictive research.

At the outset it should be noted that the distinction between predictive research and descriptive research is a nebulous one. For example, most valid predictions are based on descriptions of past activities or observations of recurring phenomena.

As the term will be used throughout this work, predictive research will refer primarily to the activities involved in developing and testing models that foretell what the outcomes will be, given the interaction of certain variables.

Descriptive Research

As its name implies, descriptive research relates to activities which attempt to reconstruct, explain, interpret, account for, or describe a phenomenon[2]. This type of inquiry may be used when unique phenomena *or* recurring phenomena are examined. An example of a unique phenomenon would be a one-of-a-kind event, an object, or an individual. Recurring phenomena, of course, are activities or events which occur many times, for example: missile firings, communications, and tactical maneuvers.

Like all research, descriptive research attempts to provide new information—information which might support earlier conclusions or cause entirely new conclusions to be formulated.

In intelligence research, new information may require that new estimates be prepared. In scientific research, new information may require that new principles be formulated when existing principles no longer adequately account for facts.[3]

Predictions, if any, evolving from only descriptive research tend to be "squishy" in the sense that they do not lend themselves to ". . .any well defined mathematical formulation that unambiguously captures the substantive problem."[4] An example of a "squishy" prediction evolving from descriptive research is the statement: "By the year ——, the Soviet Union's missile arsenal will consist of —— ICBM's and MRBM's." Clearly, this type of prediction is a far cry from the prediction of solar eclipses, from the prediction of movements of subatomic particles, and from the prediction of meteorological phenomena.

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[2]Some writers would classify *explanation* as a separate type of research. However, many "explanations" are merely *descriptions* of the interaction of variables. Explanations of events, for instance, are often *descriptions* of antecedent conditions which purportedly give rise to the subsequent events.

[3]For example, it became necessary to develop quantum mechanics to account for the movement of subatomic particles because these phenomena were not adequately addressed by Newtonian mechanics.

[4]Strauch, *A Critical Assessment of Quantitative Methodology*.

Nature of Proof in Descriptive Research

Descriptive research is distinguished from predictive research on the basis of the techniques used to test an hypothesis. Very briefly, an hypothesis is a "testable assertion,"[5] or a tentative statement that proposes " . . . causal relations between various sets of facts."[6] In descriptive research, testing an hypothesis usually involves *searching* for evidence that supports or refutes it. An historian (or an intelligence analyst), for example, might postulate an hypothesis to account for the occurrence of an event. He would "test" his hypothesis by *searching* for information that supported his hypothesis as well as for information that would refute it. His hypothesis could be said to be "valid" if the evidence obtained (and presumably, all of the evidence that existed) supported his hypothesis more plausibly than any alternative hypothesis. "Plausibility" in this instance would imply *possibility, consistency* with other facts and theories, and it might also imply *simplicity*. For example, in cases in which all other things were equal, the simple explanation (hypothesis) would be preferred over the complex.

In those instances in which an historian (or a sociologist or an anthropologist) might attempt to formulate a principle based on recurring conditions or events,[7] he would attempt to test his hypothesis by searching for other instances comparable to the event under consideration in which certain precedent conditions were followed by certain subsequent events. Should he discover

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[5]James B. Conant, *On Understanding Science: An Historical Approach* (New York: The New American Library, 1951), p. 38.

[6]Pauline V. Young, *Scientific Social Surveys and Research* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966), p. 19.

[7]For example, Spengler and Toynbee. Studies of "national character" would be examples of intelligence research that attempt to formulate principles of group behavior.

comparable instances in which the relationship of precedent to subsequent conditions existed, these instances would tend to corroborate his hypothesis. The more instances he found that corroborated his thesis, the stronger his confidence would be that his thesis was valid. The researcher would also search for instances in which the same precedent conditions were *not* followed by a certain subsequent event. Should he find such instances, his hypothesis would be invalidated. Obviously, the historian cannot cause an historical event to occur again; thus, he cannot replicate his test. He can only search for, and hope to find, conditions similar to the one under consideration. The extent to which conditions are comparable is the extent to which his confidence in an hypothesis is maintained.

Predictive Research

Predictive research also attempts to explain or to account for a phenomenon, but in addition, predictive research also attempts to formulate new principles (or natural laws) which *foretell* what the effects will be of the interaction of specified variables. Principles are fundamental truths or general laws based on observed *regularities* of the external universe. Principles are the foundation of modern scientific thought because they permit predictions to be made with a high degree of accuracy. Predictive research, of course, is most applicable to recurring phenomena. Disciplines which best exemplify predictive research in its purest form are the physical sciences.

Nature of Proof in Predictive Research

In contrast to the historian and the typical intelligence researcher who must search for whatever evidence exists to test his hypothesis, the physical (or experimental) scientist can manipulate independent variables in his laboratory according to plan. As such, he can *create* the very conditions upon which his prediction (hypothesis) is based, and he can compare almost immediately the actual outcome of his manipulation of conditions (variables) with his predicted outcome (his

hypothesis).[8] If the actual outcome of the experiment compares favorably to the predicted outcome, the scientist's hypothesis is validated.[9]

The test procedure used for validation in its broadest sense is the *experiment*. Again, in its broadest sense, an experiment may range from a mental exercise of eliminating alternative hypotheses (as an historian or an intelligence researcher might do) to a laboratory manipulation of controlled variables.

Rarely can the intelligence researcher perform controlled experiments, but often he can make numerous observations of the same kinds of phenomena. Although not as good as observations of controlled situations, these observations nevertheless can be used as inputs to predictive models.

For the sake of comparison, the scientist's procedures were simplified. The point that should be noted, however, is that the scientist can replicate his experiment dozens of times. Perhaps more important, other scientists can also replicate the same tests. Herein lies the difference between "squishy" predictions evolving from descriptive research of unique events, and "hard" predictions evolving from many repetitions of the same tests by independent researchers. The former type of prediction is usually based on a very limited sample—sometimes a sample of only one. Rules for accepting hypotheses in these cases are different from rules for accepting hypotheses based on a sample

[8]Immediate as opposed to the length of time required to test Malthus's theory of the world's population outstripping its food supply, and Spengler's theory of the decline of the West.

[9]This is an oversimplification, of course. In reality, the scientist tests the "null hypothesis"—the hypothesis which says in effect that any results obtained could have been obtained by chance. When data do not support the null hypothesis, it is rejected, and the rejection of the null hypothesis is tantamount to the acceptance of the original hypothesis.

of, say, one hundred. In the former case, possibility and plausibility enter into the picture, as well as the persuasive power of the person formulating the hypothesis—his knowledge, experience, and past history of successful predictions. In the latter case, acceptance or rejection of an hypothesis is dictated almost entirely by statistical tables.

Although the nature of proof differs between descriptive and predictive research, this does not imply that one type of proof *necessarily* approches "truth" more closely than the other. Both types of proofs are appropriate in their respective domains and equally inappropriate in the other. Gregor Mendel's principles of genetics would have been meaningless without supporting statistics, but it is difficult to see how Edward Gibbon's explanation of the decline and fall of the Roman Empire could have been enhanced by any experimental treatment. Courts of laws also have their own "rules of evidence" for establishing "proof." For the sake of accuracy, it is better to reserve the term "proof" for mathematics and to use the terms "validity" and "validate" in the context of hypothesis testing. "Proof" denotes certainty which is contradictory to the tentative nature of hypotheses and theories.

Theory Validation in a Conflict Situation

Before the reader concludes that experimentation and theory validation have nothing to do with intelligence and intelligence research, it would be well to consider what takes place when one nation attempts to ferret the operational pattern of another country's aircraft early warning system. The typical method involves sending aircraft loaded with electronic gear close to or across another country's border and to record the number, types, locations and characteristics of the radars that the enemy activates.

Having executed this maneuver a number of times, a picture of the other side's aircraft early warning network evolves. Invariably gaps exist in the picture. These gaps are filled initially with inferences or calculated guesses of the types of devices that *should* be covering a certain area based on observed regularities in other areas in the past. These inferences are testable hypotheses, and if time permitted, attempts would be made to provoke the enemy into turning on the radars in the "untested" territory so that the hypotheses could be validated. If it weren't for the fact that the enemy had the option of *not* turning on his radars (thus, was not bound by any natural law), this type of operation would qualify as predictive research in the most rigorous sense of the word.

Observed regularities of any enemy activity create the framework in which numerous kinds of quasi-predictive research activities can be performed. Recurring activities, as mentioned previously, include standing operating procedures in communication, similar patterns in conducting field operations, and similar patterns of weapons systems research, test, and development. But all of these activities are governed by choice on the enemy's part, and not by some inviolable law of nature. Hence, the strength of a prediction made on the basis of recurring activities in the past is never so strong in human affairs as it is in, say, the physical sciences. Confounding the issue is that sometimes the enemy deliberately maintains a pattern of activities to conceal some other activity, or to mislead or deceive.

Despite inherent limitations, validating predictions and attempting to establish "working principles" are fairly common activities in intelligence and intelligence research, and consideration of the nature of proof is by no means a mere academic exercise.

Models

A concept that evolved in the physical sciences, but one which has application in many other non-scientific investigations and particularly in intelligence analysis and research, is the concept of the *model*. In its simplest sense, a model is an abstraction or representation of reality. For example, chessmen are models (representations) of combatants, and a chess game is a model of conflict; a chemical formula is a symbolic representation (model) of a substance; a model airplane is a miniature representation of the real thing (with many parts missing, of course); the naval war game described at the beginning of the chapter was a model of the actual conflict; and game theory is a model of political, military, or economic conflict, again with irrelevant parts deleted. Scientific theories are also models. The advantage of models is that they enable one to predict outcomes by manipulating only symbols rather than elements of the real world. The most common type of symbol manipulation for predictive purposes is simulation.[10]

Models and the Scientific Method

Whenever a researcher formulates an hypothesis that attempts to account for the interaction of variables, he is constructing a model. The formulation of the model is a creative act; hence, the necessity for imagination discussed earlier. The quality of a model is a function of how well it accounts for the interaction of variables. In scientific models, quality is the extent to which the model predicts accurately. It is the act of determining how well a model explains or predicts that constitutes the scientific method.

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[10]Models, games, and simulations will be discussed further in Chapters XVII and XVIII.

Very briefly, the scientific method involves the following steps: 1) the researcher makes observations either directly or vicariously by studying reports of earlier observations and measurements; 2) the researcher formulates (postulates) a model which attempts to account for the phenomenon observed; 3) the researcher subjects his model to a test (the experiment). He checks his measurements, examines his logic (which is reflected in the model he postulated as well as in the design of his experiment), and compares results obtained against results predicted by his model; 4) if the results of his test are comparable to the results predicted by the model, his model may be said to be valid. If the obtained results are inconsistent with his model, and if the researcher ascertained that he made no error in measurement or observation, he may either revise his model and subject it again to the same series of tests, or he may simply discard the model and attempt to formulate a new hypothesis. The steps of the scientific method are shown in Figure VII-1.

It should be noted that the "basic" scientist is primarily concerned with establishing the quality of the model: he is not concerned with making specific predictions. Once models are validated, however, they can be used for making any number of predictions at any future time.[11] The "applied" scientist (like most intelligence researchers), on the other hand, is concerned with making specific predictions by applying the model in real situations.

The Scientific Method in Nonscientific Research

An historian or an anthropologist who postulates an hypothesis to account for an historical event or to describe the uses of a cultural artifact also constructs a model. Unlike the scientist's model, validation of an historian's hypothesis does not involve comparing actual events or conditions with predicted events or conditions. The canons or criteria for accepting

[11] Provided, of course, that the observed relationships among variables do not change.

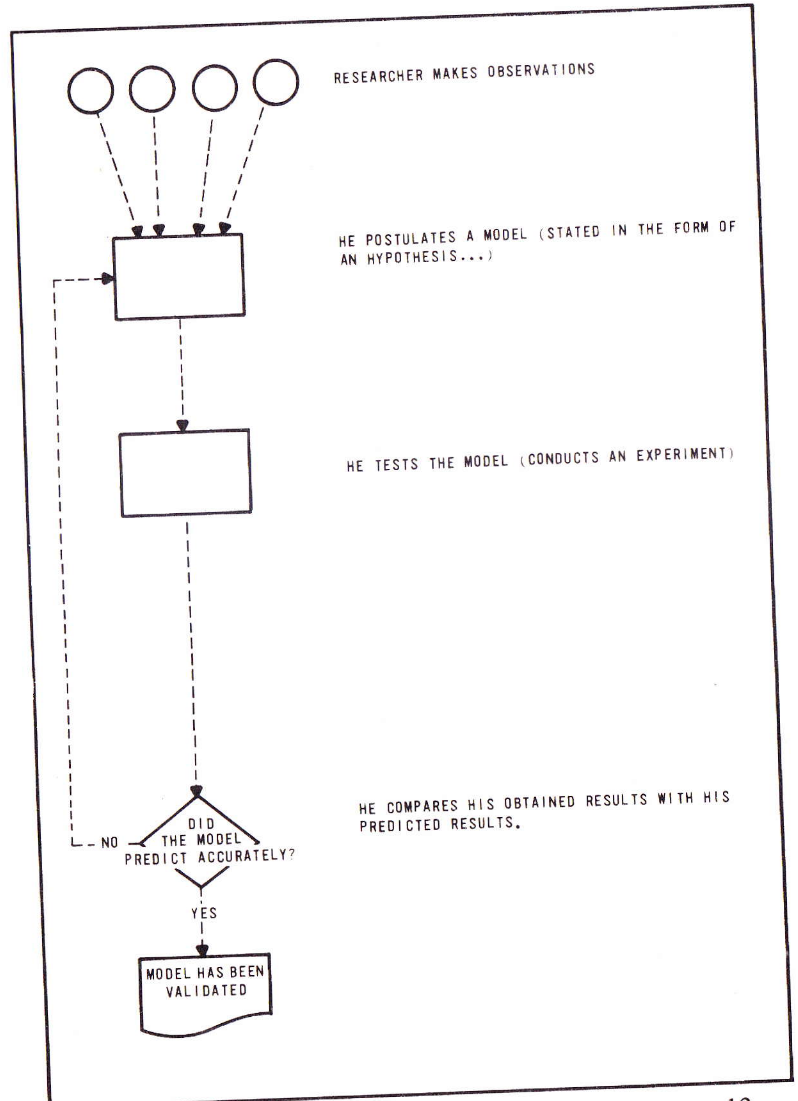

Figure VII-1. Model Validation and the Scientific Method[12]

[12] After Marshall Walker, *The Nature of Scientific Thought* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), p. 5.

an hypothesis, as pointed out earlier, are instead a matter of how well existing data "fit" the theory. But the point that should be remembered is that the steps in the scientific method are as relevant to nonscientific research as they are to validating a scientific predictive model. And with certain qualifications, the scientific method is a most appropriate methodology for intelligence research as well.

Typically, intelligence research or analysis begins when the researcher makes observations. Unlike the physical scientist who may observe his phenomena directly, however, the intelligence researcher or analyst usually makes his observations vicariously; that is, he studies documents, reads intelligence reports, studies photographs, or interviews participants or other observers. On the basis of his observations, he postulates tentative explanations of what is taking place, or why something is occurring. These initial tentative explanations are called working hypotheses. These working hypotheses are examined in terms of possibility and plausibility, and the hypotheses which seem most plausible are retained for further validation.

The retained hypotheses are tested against *new* input, and the hypothesis which is supported best by the new input (i.e., most consistent with the new input) becomes the basis for the researcher's conclusions.

In general, this procedure is not too dissimilar from the methods used by the physical scientist. But there are a number of important differences that may occur in intelligence research. For instance, whereas the experimental scientist limits his hypotheses to one, the intelligence researcher, in order to exhaust all logical possibilities more quickly, will attempt to postulate as many possible and plausible hypotheses as he can, and he may very well *test* several hypotheses simultaneously.[13] He is forced to do this because the variables cannot be replicated in the real world as they can be in the laboratory. Whereas the physical scientist can methodically test one hypothesis, then replicate the variables and test another hypothesis, and so on, until he has exhausted all of his hypotheses or until he has validated one, the intelligence researcher cannot reconstruct the situation. 2 Actors change, conditions change, and above all, time changes. Although it might be possible to recreate the physical conditions surrounding an event, it is impossible to recapture the event without taking into account the learning or experience that was gained by the participants since the original event occurred.

Ideally, hypotheses should not be tested against information used to formulate the hypotheses initially. Using the same information for both hypothesis generation and hypothesis testing may give rise to circular reasoning. However, in historical research, it may not be possible to obtain additional information; as such, the test of an hypothesis is simply the extent to which the existing facts fit the theory.[14]

3 Another difference between intelligence research and research that relates to establishing scientific principles is the role that prediction plays in validation. A scientific hypothesis is said to be valid only when a predicted event occurs. However, much intelligence research and analysis is performed for the very purpose of precluding an event's occurring; hence, it is often impossible to use an actual event for the purposes of validating a prediction.

Finally, research conducted to establish scientific principles seeks to uncover relationships that permit the prediction of outcomes of classes of events.[15] Intelligence research, on the other hand, when it addresses prediction, is more concerned with predicting specific events. 4

[13] In reality, hypotheses are never tested singly. At a minimum, there is always a null hypothesis for any hypothesis postulated, as pointed out earlier.

[14] In hypothesis *formulation* one attempts to "fit" a theory to the facts. In hypothesis *validation*, however, the test is how well the facts "fit" the theory.

[15] As an oversimplified example, theories of gravity apply as much to apples as they do to ballistic missiles.

The general plan that would be followed for validating hypotheses in intelligence research is shown in Figure VII-2.

Predictive Model Validation in Intelligence Research

Predictive model development and validation make up a significant portion of intelligence research activities. Economic Intelligence researchers and analysts, for example, employ predictive models quite frequently, and model validation may constitute a major portion of their analytical or research activities. For instance, agricultural economists may devise algorithms (or formulas) for predicting grain yields given certain variables such as acreage under cultivation, availability of fertilizer, growing season, and precipitation. The initial algorithm is a model—a model which must be validated and refined by comparing predicted yields with the actual yields. In terms of armament production, economists may again devise an algorithm for estimating the production capabilities of a manufacturing facility, given variables such as the number of furnaces, storehouses, floor space, and available transportation nets.

In Transportation Intelligence, models or algorithms are used for estimating the amount of materiel that can be moved over selected rail lines, given such variables as transloading facilities, availability of single-or double-tracked lines, availability of rolling stock and locomotives, train length, and so on. Manipulating these variables by means of computer simulation permits analysts to estimate (predict) how much could be carried under varying conditions and configurations.

Sometimes the intelligence community enjoys a windfall and an already validated model of the enemy (or his operations) becomes available for operational application. An example of this took place in World War II when U.S. intelligence analysts were able to estimate the size of the Japanese garrison on Betio (Gilbert Islands) based on the number of privies constructed out into the lagoon. The "model" that the analysts used were captured Japanese documents containing army doctrine that specified the required ratio of sanitation facilities per number of

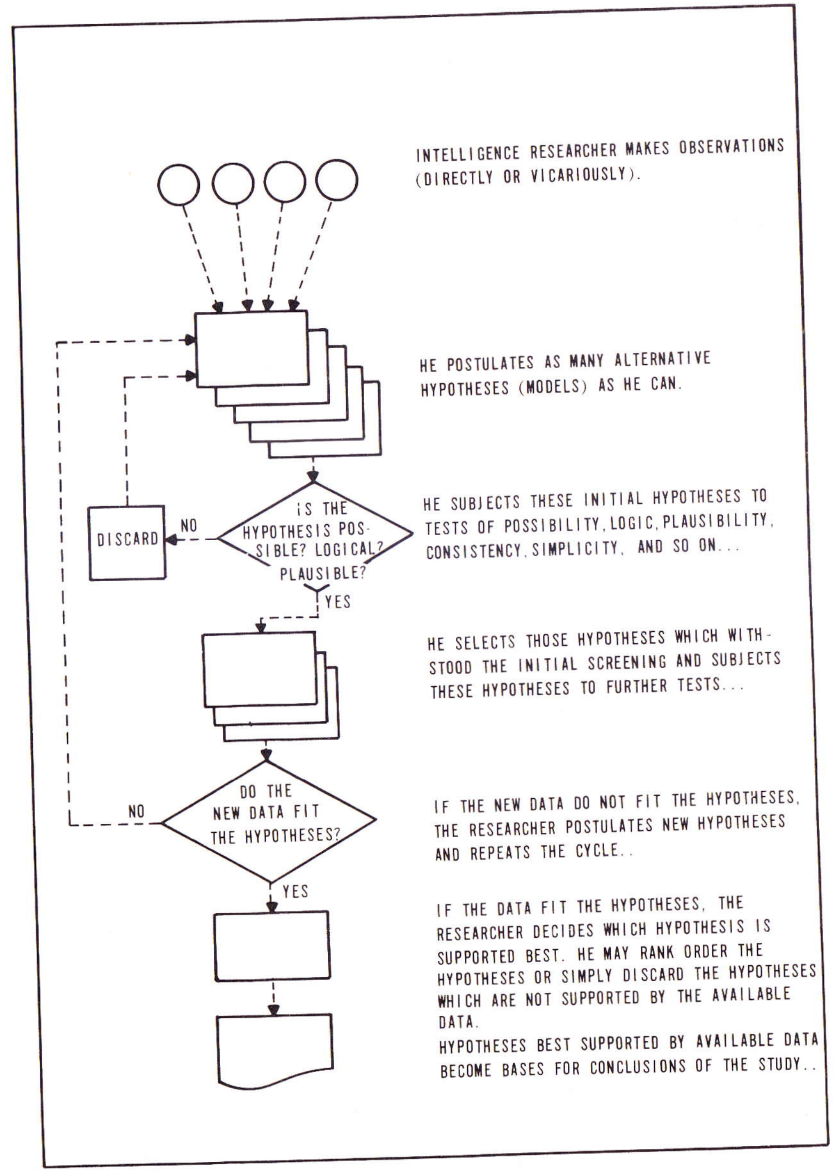

Figure VII-2. Hypothesis Validation in Intelligence Research

men. The estimated size of the garrison missed the actual number by only 64 men (out of 4715).[16]

Semantic Problems of Technical Terms

Language plays tricks on the unwary. For example, because an investigation is nonscientific does not (or should not) imply that an investigation is unscientific. Science relates to activities which attempt to establish verifiable general laws. But in the sense that science is also organized knowledge, it is not distinct from any other discipline such as history, anthropology, or archaeology. As a matter of interest, many disciplines classified as "sciences" include branches that deal with the establishment of natural laws or principles in only the most remote manner. Taxonomy in botany, zoology, and geology are cases in point. These disciplines are essentially descriptive, not predictive. And whether or not the most rigorous experimental scientist admits it, *all* science started as descriptive research.

But one of the more unfortunate tricks that language may play on the uninitiated researcher is that it might suggest that the "scientific method" is a technique used only by the scientist. This, of course, is not true. The scientific method can be applied to a range of activities from predicting movement of the earth's surface to performing maintenance on a motorcycle.[17] The scientific method is *not* a body of arcane procedures that unerringly reveal truths. The scientific method

[16] Samuel Eliot Morison, *History of United States Naval Operations in World War II,* vol. VII: *Aleutians, Gilberts and Marshalls, June 1942-April 1944* (Boston: Little, Brown and Company, 1961), p. 149.

[17] For a nontechnical discussion of the scientific method applied to everyday problems, the reader is advised to peruse Robert M. Pirsig's *Zen and the Art of Motorcycle Maintenance: An Inquiry Into Values* (New York: William Morrow & Company, Inc., 1974)–a book that, in reality, says virtually nothing about Zen, and very little about motorcycle maintenance. Despite the title, the book is essentially a critique of rational thinking.

is simply a tried and tested set of procedures for seeing how well a theory works. As such, the scientific method can be applied to any type of inquiry in which theories are developed and tested. In this sense, the scientific method is a most appropriate set of procedures for intelligence research.

Summary

▷ Predictive research and descriptive research are the two types of activities which constitute the major portion of intelligence research and analysis activities.

▷ Descriptive research attempts to reconstruct, explain, interpret, account for, or describe a phenomenon. "Proof" in descriptive research involves searching for data that support or refute an hypothesis or theory.

▷ Predictive research attempts to formulate new principles (or natural laws) which would enable the researcher to predict, anticipate, or foretell what the results of the interaction of variables will be. "Proof" in predictive research involves comparing a predicted outcome against a real outcome.

▷ As the term is used in this book, predictive research will relate primarily to the process of developing and validating predictive models.

▷ Procedures for developing and validating predictive models are sometimes referred to as the "scientific method."

▷ The scientific method involves four steps:

- The researcher makes and records observations
- He formulates a conceptual model which attempts to account for the phenomenon (postulates hypotheses)
- He tests the model (in laboratory situations he would experiment)
- He compares the predicted outcome from his model with the real outcome. If the results are comparable, the model is said to be valid

▷ The scientific method, with modifications, is applicable to nonscientific investigations as well.

▷ Theory validation in intelligence research differs from theory validation in scientific research in the sense that many hypotheses may be tested at the same time. Furthermore, rarely can the intelligence researcher control variables in the sense that a scientist in a laboratory can. For the greater part, intelligence researchers must search for conditions or events that would permit them to test a theory. Physical scientists, and other experimental scientists can create the conditions needed to test a theory.

CHAPTER VIII
THE RELATION OF INDUCTION AND DEDUCTION TO THEORY BUILDING IN INTELLIGENCE RESEARCH

The basic postulate of all science states that nature is, to some degree, predictable; this postulate is merely an inductive inference based on man's experience. He has found that attempts to predict have been successful enough to be useful in the struggle for survival. The postulate merely serves notice that man expects to continue the efforts to make predictions as long as they are useful to him.

Marshall Walker

On November 3, 1943, Adolf Hitler issued an order for the defense of the western approaches to *Festung Europa*. All indications, according to Hitler, pointed to an Allied invasion of France by 1944. The most likely place for the invasion was the Strait of Dover. Defenses were to be strengthened to the maximum in the areas along the strait and Feldmarschalls Gerd von Rundstedt and Ervin Rommel were assigned the mission of defeating the enemy invasion forces.

Von Rundstedt, like Hitler, believed that the Allied invasion would take place between Le Havre and Dunkirk, despite the concentration of German coastal defenses, because an invasion here would permit the Allies to deploy in the plains of Picardy and drive eastward to the Ruhr. Very few German generals thought that the Allies would be foolish enough to risk getting bogged down in Normandy. Furthermore, the launching platforms for the V-1 and V-2 bombs and rockets that Hitler was preparing to use in mass attacks on England were close to the Strait of Dover.[1] In short, it was only "logical" that the Allies

[1] Samuel Eliot Morison, *History of United States Naval Operations in World War II*, vol. XI: *The Invasion of France and Germany, 1944-1945.* (Boston: Little, Brown and Company, 1962), pp. 39-49.

would launch their inevitable invasion across the Strait of Dover, the classic invasion route for Alfred the Great, and the route specified in the aborted plans of Napoleon Bonaparte and later Hitler, himself, in 1940.

The Allied invasion did not take place across the Strait of Dover, of course. On the basis of assumptions, generalizations based in part on elaborate deceptive measures of the Allies, and faulty deductions, the German High Command made one of the most fateful decisions of the war. The errors made by the German High Command were errors of *induction*. Unfortunately, for commanders in the field, for intelligence analysts at their desks, and for intelligence researchers in general, there are no safeguards against drawing faulty generalizations–no rules to follow, and no exercises to "strengthen" one's mental faculties so that correct generalizations necessarily follow from observations.

This chapter will discuss the reasoning processes involved in intelligence research and analysis. More specifically, the chapter will discuss the reasoning processes as they relate to different steps in the scientific method. In this chapter, the term *hypothetico-deductive method* will be used in place of *scientific method*. Both terms mean the same thing. Although *hypothetico-deductive* method is not as familiar as the term scientific method, the term describes the problem-solving process more accurately, and it avoids the connotation that a procedure may be limited only to scientific inquiry.

Initially the chapter will discuss the mental processes by which vague concepts are translated into hypotheses which can be tested. Then the chapter will discuss the mental processes involved in testing hypotheses. With respect to formulating hypotheses, however, a word of warning is appropriate at the outset: there is little advice that can be given to the researcher at the hypothesis formulation stage of his inquiry. Much of the activity that precedes the formulation of testable hypotheses is unstructured, amorphous, and perhaps even chaotic.

The processes that a researcher performs at the prehypothesis stage defy generalization and the stereotyped notion of the researcher's moving unerringly from a vague concept to a refined and validated theory is largely a myth. In fact, it may come as a surprise to the new researcher that the most agonizing phase of a research activity is the pre-hypothesis stage. Having formulated testable hypotheses, the avenue of progression for the researcher is clear. He can delineate what must be accomplished, he can specify the sequence of events, he can predict the form of his final product, and with experience, he can probably tell how long it will take to complete his inquiry. But it is indeed the rare individual who can anticipate what conditions and how much time will be required to formulate hypothesis.

Induction

Induction is the intellectual process of drawing generalizations on the bases of observations or other evidence. Induction takes place when one learns from experience. For example, induction is the process by which a person learns to associate the color red with heat and heat with pain, and to generalize these associations to new situations. Obviously, induction is essential not only for the transmission of knowledge, but also for survival.

Induction is a process of discovery. Induction occurs when an analyst or researcher begins to see certain *relationships* in the phenomena he is observing. For example, an analyst or researcher might notice from his systematic examination of Foreign Broadcast Information Service (FBIS) reports that unusually bellicose statements were uttered by spokesmen of Country "Z" prior to the time when arms agreements concluded with Country "Y" were announced formally. Or the analyst may have noted that an invariant sequence of events preceded Country "Z's" nuclear tests.

Induction occurs when one is able to postulate causal relationships. Intelligence estimates are largely the result of inductive processes, and, of course, induction takes place in the formulation of every hypothesis. Unlike other types of intellectual activities such as deductive logic and mathematics, however, there are no established rules for induction.

Describing how induction takes place is tantamount to describing how one conceives ideas. Obviously, knowledge and experience are important for one to generate ideas, and certain personal traits of the investigator, such as curiosity, or an obsession with a lack of closure, are important contributors to induction. Imagination and "powers" of observation clearly figure into the inductive process.

Physical and social environments can also be created that are conducive to induction—environments in which a researcher may try out ideas without fear of ridicule from his colleagues, for example—but different people react differently to various conditions, and for some researchers an element of stress, anxiety, or discomfort is conducive to sharpening creative powers.

Observations usually precede all valid generalizations. Although one cannot guarantee that making numerous observations will necessarily yield generalizations, one can state that without observations, the likelihood of developing valid generalizations is indeed remote.

The objective of the inductive phase in the hypothetico-deductive process is to arrive at a number of testable hypotheses. Since the quality of the hypotheses is a function of the knowledge and experience of the observer, one way of improving hypotheses is to involve several people in the hypothesis formulation (inductive) phase. At times it may also be profitable to employ a "naive observer"—one who is not deeply involved in the problem at hand. Naive observers contribute by questioning basic assumptions, assumptions which those deeply involved in an activity may take for granted. The inductive phase of the hypothetico-deductive process ends when testable hypotheses are formulated.

Deduction

Deduction is the process of reasoning from general rules to particular cases. Deduction may also involve *drawing out*, or analyzing the premises to form a conclusion.[2]

[2]The word "deduction" comes from the Latin *deducere* which means to draw out.

In the example of induction mentioned earlier, an analyst noted a pattern of events relating to Country "Z's" nuclear tests. His generalization at that point may have taken the form: Events 1, . . . n, always precede nuclear tests in Country "Z". After arriving at this generalization, the analyst may have received reports that Events 1, . . . n were occurring in Country "Z". On the basis of this information, the analyst would conclude that Country "Z" was about to test another nuclear device. Initially, the analyst reasoned *inductively* from numerous observations to a generalization. When the analyst reasoned from a generalization to a specific case, he reasoned *deductively*. His reasoning progressed from premises to a conclusion. The major premise was that Events 1, . . . n always preceded nuclear tests in Country "Z". The minor premise stated that Events 1, . . . n had been reported. Assuming that Events 1, . . . n were not associated with any other activity, the logical conclusion that would be reached was that Country "Z" was about to test a nuclear device.

The example just cited was overly simplified, and like most simplifications, it glossed over points that might make a significant difference in intelligence research.

Deduction works best in closed systems such as mathematics, formal logic, or in certain kinds of games—war games played on a computer, for example, in which all the rules for playing the game are clearly spelled out. In the statement: "This is a triangle; therefore the sum of the interior angles will equal 90 degrees," the validity and truthfulness of the conclusions would be apparent to anyone with a knowledge of geometry. Conclusions, if drawn correctly in closed systems, are *always* valid.

But intelligence research rarely deals with closed systems; thus, conclusions may still be drawn correctly, but the premises from which they are drawn may not be true. In the example of the nuclear tests, for instance, Country "Z" may have assumed that its activities were being monitored, and, for strategic reasons, embarked on a large-scale deception program. In this case, the premise that Events 1, . . . n always precede nuclear

tests in Country "Z" would be false, and consequently, even if the researcher or analyst reasoned validly from the premises, the conclusions would still be false. The implication for intelligence research is apparent: human activities rarely involve "closed systems" in which conclusions necessarily follow certain premises. Therefore, in intelligence research, deduction must be used carefully with a full awareness of the limitations of the processes, and with an awareness of potential errors in the premises.[3]

Induction and Deduction in the Hypothetico-Deductive Process

It was mentioned previously that in the hypothetico-deductive process, induction ended with the formulation of testable hypotheses. Hypotheses, it will be recalled, are theories or unproved assumptions which relate or explain different facts. The purpose of an hypothesis is to guide the researcher in his search for evidence. Without hypotheses to delimit the boundaries of the search, the researcher would be unable to ensure that any collected data were relevant or germane to his purposes. As Darwin pointed out, " . . . all observation must be for or against some point of view [an hypothesis], if it is to be of any service."

Again, the greater the number of hypotheses formulated, the greater the chance that one of the hypotheses will prove to be the correct one. This is important to remember because there is a tendency among many researchers to "lock in" early on a favorite hypothesis to the exclusion of others. The number of hypotheses that might be generated is infinite, but at the minimum, the researcher should formulate at least three.[4]

[3]Rules for deduction can be found in most textbooks of logic. Examples of deduction and induction applied to intelligence problems are contained in the series of programmed texts, *Logic for Intelligence Analysts,* mentioned earlier.

[4]E.g., the original hypothesis, the null hypothesis (which is essentially the refutation of the original hypothesis), and one more hypothesis that is completely independent of the other two.

Typically, hypotheses in problem solving contexts are stated in the form of the syllogism, i.e.: "If , then ." This first statement constitutes the major premise, or the generalization. The next statement (the minor premise) would include the actual evidence to date. To return to the nuclear test example, the syllogism would look like this:

> *If* Events 1, . . . n, *then* a nuclear device will be tested. (Major Premise)
>
> Events 1, . . . n, have been reported in Country "Z". (Minor Premise)
>
> Therefore, a nuclear test is imminent in Country "Z". (Conclusion)

The relationship of inductive and deductive reasoning to the hypothetico-deductive process (the scientific method) is shown in Figure VIII-1.

As critical as these two reasoning processes may be, it should not be assumed that every research program will necessarily require that both processes be performed. Nor must the researcher formulate hypotheses for every type of intelligence research project. Certain types of intelligence problems will require only the addition of new information. In other cases, the hypotheses may be given to the researcher for testing as part of his assignment, thus eliminating the need for the researcher to draw initial generalizations. Sometimes a research project will involve only the inductive phase and the product will consist of a generalization that was not yet tested. However, in the case of self-initiated intelligence research efforts, it is difficult to see how one could progress systematically and not employ the hypothetico-deductive process.

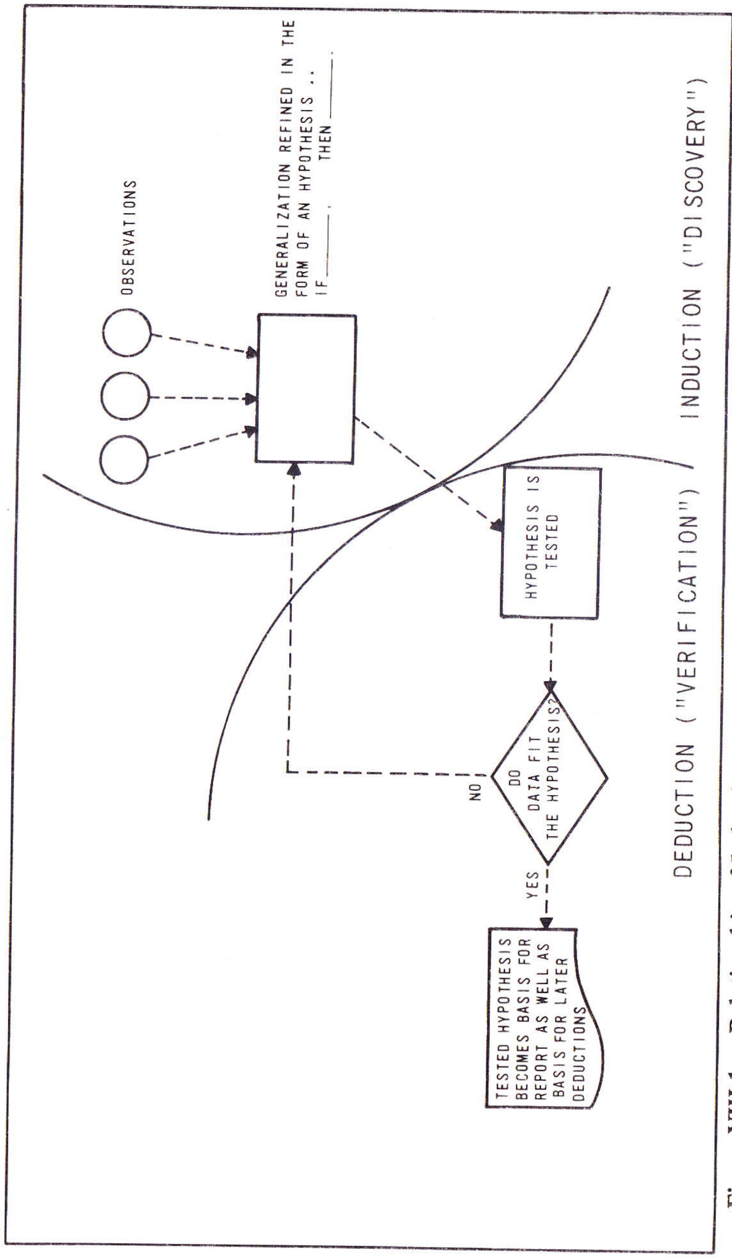

Figure VIII-1. Relationship of Inductive and Deductive Reasoning to the Hypothetico-Deductive Method. (These processes can also be considered in terms of discovery and verification, as will be discussed in Chapter XIV.)

Summary

▷The terms hypothetico-deductive method and scientific method mean the same thing; however, the term hypothetico-deductive method is a more accurate description of the process and it does not suggest that the method is necessarily limited to scientific investigations.

▷Induction is the intellectual process by which one arrives at generalizations on the bases of observations or other evidence. Induction is the process by which testable hypotheses are formulated.

▷Deduction is the process of reasoning from general rules to particular cases. Conclusions drawn deductively (and correctly) in "closed systems" such as mathematics and formal logic are always valid. Unfortunately, rarely does intelligence research involve closed systems.

▷Induction is involved in the process of *discovery*, e.g., noting certain relationships among phenomena that previously were not known to exist. Deduction is involved in *testing* and *verifying* the generalizations formed inductively.

▷Not all research requires both induction and deduction. Sometimes a research project (assigned or self-initiated) may conclude with a set of generalizations. Other times a research program may be initiated to test a set of generalizations.

CHAPTER IX
PLANNING THE RESEARCH PROGRAM – PART ONE: PROBLEM DEFINITION

The adolescent envisions the researcher as one who dreams up creative ideas, the needed resources miraculously appear, and the hero, in a state of eager anticipation, begins his investigation. Those of us who are researchers would add some less romantic steps, one of which, the preparation of the proposal to make the resources "miraculously appear", has become quite important. On occasion, it can be a serious hurdle to the implementation or trial of an important idea.

David R. Krathwohl

Every well-performed research project involves four major phases: problem definition, data collection, data analysis, and report preparation. The normal sequence of events progresses from the translation of an identified need into a plan of action, the execution of that plan of action, and the submission of the results of the planned research activities.

There is nothing sacrosanct about the sequence in which the steps are performed. In many instances in intelligence research, data collection may occur before a problem is defined or becomes apparent. Very often data analysis begins before all of the data are collected, and report preparation usually begins before all of the data are analyzed.

This chapter discusses the steps that should take place in the problem definition phase of a research project. This is a critical phase of the project because decisions made at this phase affect the manner in which the entire project will be conducted.

At the outset, it should be noted that the problem definition phase involves more than merely selecting a research topic. The problem definition phase is, in reality, a planning

phase in which all of the factors which would influence the successful completion of a proposal effort must be considered.

The problem definition phase involves two major functions: 1) defining the problem, and 2) determining the feasibility of the purposed approach for attacking the problem. These functions are interrelated. The nature of the problem determines what resources are required by the researcher. The available resources, time, funds, and manpower determine whether or not the problem as stated can be addressed effectively.

Problem definition is an iterative process of selection and refinement. On the basis of need and the capabilities and interests of the researcher, general problem areas are identified. Within these larger problem areas, a number of tentative topics may be chosen. These topics, in turn, are examined initially with respect to their value to the intelligence community and to the researcher, and then with respect to the feasibility of actually conducting the research.

Defining the Problem

The objective of this step is the identification of a research topic. This section will discuss the factors that should be taken into account as the research problem is defined and the topic selected. The factors include the sources and origins of problem areas, the need, and the many decisions that must be made in delineating the scope of the proposed research project, such as specifying terms of reference and operational definitions.

Sources and origins of research projects

Research projects evolve from recurring needs of a sponsoring agency or headquarters, from specific non-recurring needs of an agency or headquarters, or from problem areas perceived by the researcher himself. Examples of research projects that are assigned are periodic reports and updates. Usually these types of research projects are scheduled and generally pose no special problems to the researcher. Another type of research project that is assigned are special *ad hoc*

studies. This type of project might cause problems because deadlines are often short, the issues are critical, and data may not be available. An advantage of all assigned projects, however, is that the terms of reference are spelled out in the assignment. Thus, the researcher need not ponder the scope, length, complexity, operational definitions, availability of funds, need, nor the feasibility of the project as he must do with self-initiated projects.

Self-initiated research projects might evolve from a problem an intelligence staff officer encountered on his last tour of duty, or from chronic problems facing the G-2 or J-2 Section of the organization to which he will be assigned. Perennial problems facing the intelligence community are always potential sources for research topics. These problem areas can be spelled out in detail in discussions with various agency spokesmen. Conceivably, a research project currently underway at an agency might be enhanced by a supplementary effort, provided that the supplementary effort could be completed in time to be of value. Current intelligence reports, and even collection requirements, or Statements of Intelligence Interest (SII's) might suggest topics for self-initiated research programs.

Need

A proposed self-initiated project that addresses a critical need stands an excellent chance of being approved and funded. Projects that address peripheral needs or potential future needs require that the researcher explain where and how the results of the effort would be of value to the intelligence community.

At least part of this justification would include ascertaining whether or not the study has already been done. This should entail a search of the various agencies' classified holdings as well

as an initial survey of the open literature.[1] This initial literature survey also helps the researcher determine whether or not there is sufficient information available to conduct the study.

Simply because a study had been done in the past does not mean that the researcher must rule out the possibility of repeating the study or carrying out a similar research project. Certain types of subject matter have short "shelf life." An example would be a general population's attitudes toward a specific issue. As conditions change, public attitudes may change accordingly and, therefore, may warrant reexamination. Personal, military, and political alignments change, sometimes in surprisingly short time, and findings produced by an earlier study may be sufficiently obsolescent five years later to warrant reconsideration.

Studies in which methodological problems hampered data collection or analysis are always logical candidates for reexamination when new techniques become available or when military or political conditions change so that the researchers have access to areas that were formerly denied. Sometimes the discovery of new information such as diaries, memoirs, or private correspondence may cause earlier findings to be reexamined. The same is true when formerly highly confidential official documents are made public.

Experiments in which the original researcher failed to consider certain factors, or experiments in which the then-existing technology did not permit accurate observation and measurement are candidates for reexamination, as are studies in which bias on the part of the original researcher is suspected. In short, because a study was done in the past does not rule out

[1]The researcher might want to examine *Dissertation Abstracts* (Ann Arbor, Michigan: University Microfilms, Inc.) at this step. *Dissertation Abstracts* is a monthly compilation of doctoral dissertations submitted by over a hundred institutions. Various professional organizations also publish abstracts of research reports or descriptions of research in progress. Abstracts of studies completed at the services' senior colleges might also be examined, for example, the *Journal of Abstracts* published by the Naval War College.

the possibility of doing it again. The criterion to consider in repeating earlier studies is the likelihood of producing new knowledge of value to the intelligence community.

Scope

Limiting the scope of the research project is one of the more critical early tasks the researcher must perform. Typically, the researcher underestimates the magnitude of his proposed effort. For example, he may not be aware of the vast quantity of data he must screen in order to obtain only a few kernels of useful information. Furthermore, unless a topic is delineated carefully, the researcher may find that his topic has no realistic bounds. For instance, a researcher examining the causes of the Bolshevik Revolution in Russia could very easily progress backward through the decline of the Romanovs, to the decline of the Roman Empire, to the rise of Constantinople, and to the birth of Christ!

An intelligence researcher with an interest in history and geography might select initially "The Strategic Significance of the Dardanelles" as a research topic only to discover that without addressing the who and when questions, adequate coverage of the topic would require at least some consideration of the Graeco-Persian wars and of all intervening conflicts since the fifth century. Interesting, perhaps, but this background coverage would probably be of little value today.

The cast of characters expands exponentially in historical research, and without limits or guidelines for determining who will be studied, the researcher may be soon overwhelmed by the comprehensiveness and magnitude of his poorly defined topic.

Terms of reference

Delineating the scope involves establishing *terms of reference.* Terms of reference are descriptors which define the boundaries of the research effort. Terms of reference can be established with respect to time periods considered, with respect to specific geographic locations, with respect to events or movements, and with respect to significant personalities to be considered in the study.

Defining terms of reference also includes:

- Stating the problem
- Stating assumptions relating to the subject matter
- Stating the hypotheses if the nature of the research is such that hypotheses must be tested[2]
- Formulating operational definitions
- Proposing a title (which may contain many of the same terms used in the statement of the problem)[3]
- Describing briefly the methodology to be used (either in data collection or data analysis)
- Describing sources of data if the sources are unusual
- Indicating completion dates (anticipated dates, if the project is self-initiated)
- Estimating the manhours required (if the project is assigned)
- Identifying coordination required and any additional assistance needed from support groups (photo-interpreters, or translators, for example).

In the case of an assigned project, or in the case of a project that is essentially a replication of an earlier project, an initial outline of the anticipated final product might also be submitted as a term of reference. An outline makes explicit to those who

[2]Not all research required hypotheses. For example, a survey to determine the *status quo,* or to establish what exists at present, would not necessarily involve hypotheses.

[3]Writing titles is an art. Intelligence reports, unlike literary works produced for public consumption, do not (or should not) depend upon a provocative title to attract readers. Numerous problems arise when a title does not accurately reflect the content of a report. The amount of time and money wasted in cataloging, retrieving, and examining documents whose titles are misleading is mind-boggling. If possible, the title should contain the what, where, when, or who, if important individuals are discussed in the report. In the process of delineating the problem, the title may be revised several times before a research project is completed.

must approve a proposed effort the breadth of coverage and the extent of detail that the researcher proposes to provide. In the case of self-initiated projects, however, the researcher will more than likely be forced to revise the outline constantly as his project progresses, hits unanticipated snags, and employs alternative collection or analysis procedures.

The nature of the outline also depends upon the number of researchers working on the effort and the experience and personal preferences of the researcher. Generally, efforts involving the contributions of several researchers require a more structured outline than would an effort staffed by one person.

Then, too, there are individual preferences. Some researchers prefer to synthesize a highly detailed skeleton of the report initially and then "flesh out" the skeleton with specific information and transitions. Other researchers prefer to work with only a very general outline which is refined and revised as data are collected and analyzed, and as implications of the analyzed data become evident.

Certainly the experience of the researcher is a factor to consider in deciding how detailed an outline should be. Experienced newspaper reporters, for example, can write a story quickly without preparing a detailed outline simply by stating the most important fact first, followed by the next most important fact, and so on. The outline is a tool for preparing a report: it is not the report itself. Consequently, the amount of time spent preparing the outline should be proportional to the scope of the overall effort.

Operational definitions

Operational definitions must be made at this stage. An operational definition is the *writer's* translation of a concept into observable (empirical) terms. To put it another way, an operational definition is a concept stated in terms of that which can be observed and, ideally, in terms of the means by which the concept can be measured or quantified.

The concept of "net capabilities" is an example of a term requiring operational definition. With respect to net capabilities,

the questions must be raised: *To what specific action* do the net capabilities relate, and *in what units* are the capabilities to be expressed? "Power", "revolt", and "instability" are also common terms that require operational definitions.[4]

There need not be universal agreement on the operational definition (although it helps), but the writer must make clear what he means when he uses abstract terms such as leadership, power structure, revolt, strategic significance, and so on. Again, this process of spelling out operational definitions also helps delineate the scope and establishes the referents by which conclusions can be arrived at and evaluated.

Broad topics or limited topics?

Delineating the scope of the effort requires the researcher to decide if he intends to treat a broad topic in general terms or a limited topic in precise terms. It is the broad topic that causes problems. Typically, the scope of a broad topic is so great that it exceeds the constraints of cost, time, and manpower.

Another problem with broad topics is that often the treatment tends to be superficial and, thus, of little value to anyone who needs substantive information. To produce useful, substantive information about a broad topic area, the researcher must know his topic well before he begins his project, and this criterion excludes most students.

This is not to rule out categorically any consideration of broad topic areas. At times coverage of a wide topic area can provide very useful information. Examples of broad topic coverage might be evaluations of previous research, or surveys of literature relating to a specific topic. Generally, broad topic coverage is appropriate in new areas or in areas in which little is known. The use to which the product will be put would also be a factor in determining whether the researcher should opt for a broad coverage or a detailed specific coverage.

[4]Degrees of instability, for example, can be expressed in terms of events corresponding to points on a Guttman Scale—events such as the resignation of cabinet officials (at one end of the scale), and a coup d'etat and civil war at the other end of the scale.

Determining the Feasibility of the Approach

The objective of this step in the problem definition phase is to determine whether or not the topic can be addressed in light of constraints of time, manpower, available resources (including information), and the capabilities and interests of the researcher.

Time

The constraint that permeates every type of intelligence research is time. Even the student in the academic environment of the Defense Intelligence School has time limitations in which his research must be completed. Researchers in an operational environment typically have shorter response times, but these research projects are often team efforts, and in many cases the addition of other researchers can compensate for limited time. Nevertheless, the length of time available is a major determinant in the scope of a proposed project, and this constraint makes realistic scheduling and planning all the more critical.

Again, inexperienced researchers typically underestimate the amount of time that will be required to carry out their proposed program. Most government-sponsored research necessitates coordination. If the research involves contact with foreign nationals, coordination requests may have to be transmitted from the U.S. Department of State (or Defense) through the hierarchy of another government. The researcher may have to spend many hours explaining the nature of his request to headquarters of every echelon through which the request passes. Protocol is important, chains of command may not be bypassed, and all of this takes time.

Admittedly, access to remote computer terminals may save time in collecting archival data, but trips to archives may be required nevertheless. Again, procuring travel funds, forwarding clearances, establishing points of contact at the visited agency, and making protocol visits take up valuable time. Especially frustrating are instances in which "leads" fail to yield any substantive information, or instances in which archives which should contain the required information yield little of value.

Blind alleys are encountered in every research project. They are exasperating, costly and time-consuming. But they must be anticipated.

Manpower

At times the addition of other team members can speed up research activities, as mentioned earlier. Additional manpower is especially helpful in maintaining files, obtaining reference material, checking sources, and preparing copy for publication. Planning and scheduling are important to ensure that assistance is available when it is needed most.

Available resources

The amount and quality of resources at the disposal of the researcher help determine the scope of the research effort. Resources include sources of information—both archival and human—as well as data collection capabilities, and analysis and processing capabilities. With respect to available resources, the intelligence researcher has a distinct advantage over his academic counterpart. The intelligence researcher with the appropriate clearances and the need to know has access to virtually every archive maintained or supported by the U.S. Government. However, the researcher still needs to know *what* exists, *where* it exists, and *how* to go about obtaining what he needs. In the unlikely event that the information he needs does not exist in any government archive or non-governmental repository, and if the research topic is considered sufficiently important to warrant it, collection requirements might be levied on appropriate field offices and organizations.

Washington, D.C., and the immediate area surrounding the District, probably have a greater concentration and variety of data processing equipment than any other place in the world. With the remote terminals and time-sharing equipment available at the Defense Intelligence School, gaining access to a computer should pose no serious problem to the researcher.

Unlike the problems which face most researchers, the intelligence researcher may find that he has *too* much information at his disposal. His job, then, is one of optimizing his data

collection and analysis so as not to become overwhelmed by the volume of information. Again, established terms of reference and (later) hypotheses provide guidelines for determining that information which is extremely important, and that information which is of peripheral interest.

In certain types of research programs, as mentioned earlier, data already existing in the various repositories (archives, data bases, etc.) will not satisfy the researcher's needs. In these instances, the researcher must plan special data collection efforts. These collection efforts may include making firsthand observations (naturalistic or controlled), or administering questionnaires, or conducting interviews.

Even when only archival data are used, it may be necessary to devise formats for recording information. Consequently, the researcher must also consider the manner in which he proposes to collect his data in the initial planning and problem definition stages.

Not to be overlooked are methodological problems in analyzing data. When limited amounts of archival data are used, analysis can be performed without special facilities. However, if large quantities of raw data must be reduced, or if complex operations must be performed on the data, then the use of data processing equipment is essential. Again, this must be anticipated in the planning stages.

Cost

Self-initiated research efforts which can be completed with existing materials, sources and facilities do not pose problems in funding. Problems arise, however, when travel is required, when special collection activities must be implemented, or when large amounts of time must be spent on data processing equipment. Communications can be expensive when AUTOVON facilities cannot be used, or when much written correspondence is required. If the research topic is not perceived to be of critical value, the researcher may have to cover these costs personally. In addition, the researcher may have to cover the costs of clerical assistance. The costs of materials should not be

overlooked—materials such as basic references, in some instances, and the minutiae required by every research project—stationery, cards, typewriters, and so on. Projects that require the use of special equipment—laboratory facilities, for example—may increase costs. Surveys and polls involve many additional costs such as postage, printing of questionnaires or interview schedules, and interviewer fees (in some cases).

Should data collection require travel in the hinterlands of a foreign country, special personal equipment may have to be procured, and if data collection involves several people, obtaining this equipment may be tantamount to outfitting an expedition.

All research activity involves some expense, and consideration of available funds should enter into all research planning.

Capabilities and interests of the researcher

The researcher must not overlook his personal knowledge, skills, and interests when he selects a research topic. For example, a researcher with no knowledge of research design or of basic statistics would be well advised to stay away from programs involving laboratory experimentation. Researchers who require extensive use of data processing equipment need certain skills and knowledge if they are to use these facilities effectively. Admittedly, research is a learning process, but without a minimal level of background knowledge or skills, the researcher is in a poor position to make even a modest contribution. In an academic environment, the researcher may have to take time to develop requisite skills or acquire sufficient background in a subject area in order to address it effectively; but in light of the time constraints in intelligence, this is rarely feasible in an operational environment.

Because of dispositions, personal proclivities, and so on, certain types of research activities or subject matter may be distasteful to the researcher and nothing can be more stultifying than poring over screed that is tedious, monotonous, and uninteresting. Invariably, the research product reflects the

enthusiasm and interests of the researcher; therefore, selecting an interesting topic is one method of maintaining quality control.

Feasibility: The All-Inclusive Issue

Throughout all of the initial planning steps of a project, one question must be asked constantly: Is the proposed effort feasible? Limiting the scope, ensuring the availability of funds, and planning for sufficient lead time increase the likelihood that the program can be completed successfully. But these factors cannot guarantee success.

Likelihood of successful completion is an important criterion in gaining approval for a self-initiated project. If any government funding is involved in the self-initiated project, intelligence managers (and faculty advisers) want some reasonable assurance that the effort will be worth the expenditure. Even if funding is not involved, the researcher is making a large investment of his own time and energy. Every graduate student has heard "horror stories" of advanced degrees being withheld for years until some major stumbling block had been removed and the research had been completed successfully. Delays are burdensome to the researcher and nonproductive to the intelligence community.

Aside from a topic that may be too broad with respect to available time and resources, factors that contribute most to making a project unfeasible are nonexistent or unavailable data. Therefore, the researcher should pay especially close attention to primary and alternate methods for collecting the data he needs. That data relating to a specific topic *do not exist* in any archive or in a form in which they can be used is nothing new, and this is why data collection typically takes up such a large portion of a research effort. But that data are *unavailable* is another problem.

Data may be unavailable for a number of reasons: there may not be any sensor capable of detecting a certain emanation; or the state of the art may be such that a sufficient degree of resolution has not been attained to make a detected emanation useful. But these are secondary conditions relating to a larger problem, namely, inaccessibility to the target of interest. A target of interest may be a fortification, a production facility, or a weapons system. But the target of interest may also be a sample of the opposition's general population, or the party cadre in a capitol city. In sensitive political environments, even friendly populations may be inaccessible to the researcher, and the likelihood of his acquiring data directly from these "denied" groups is very remote. Problems in obtaining information about "denied" groups may be so great as to warrant research in their own right.[5]

In other cases, data might be obtainable, but only at great risk to the collectors. Here a judgment must be made as to whether the data are worth the risk entailed in collecting them. It is highly unlikely that any *self-initiated* program involving risks to lives or equipment would be approved. If the topic addressed were indeed so critical, the project probably would have been assigned in the first place.

The researcher should consider that even when he has direct access to the data, political or military conditions may change suddenly and the data may become inaccessible. One method of increasing the feasibility of the proposed effort is to plan a series of alternative data collection procedures. Ideally, the data collection procedures would range (initially) from those in which the researcher could make direct observations, to those in which the researcher could make only inferential judgments. As undesirable as inferences may be compared to direct, firsthand observations, making decisions on inferences when facts are not available is not uncommon in intelligence.

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[5]A case in point would be the studies funded by the Department of Army to devise techniques for assessing the effectiveness of psychological operations directed toward denied audiences.

Problem Definition: The First but Not Final Phase of the Planning Activity

It should be apparent that the process of defining the research problem involves more than simply picking a topic. Defining the problem involves consideration of every phase of the entire research program. Defining the problem is, in fact, a micro research program in its own right. Factors that determine whether a proposed program is relevant and feasible are interrelated, and any one factor in a self-initiated program might impact sufficiently on the others as to make the entire program unfeasible.

Defining the problem is the first phase in the planning process. But this phase does not end when the next phase begins. Throughout the conduct of the overall project, the original problem may be further refined and delineated. It is not unusual to discover in the course of a research program that certain questions subsumed under the larger original question were more important than the initial topic. The distillation process is common (and desirable) in self-initiated research programs, and the more specific a topic becomes, the greater the likelihood that the researcher will be able to conclude his project successfully. Steps in the problem definition phase are shown in Figure IX-1.

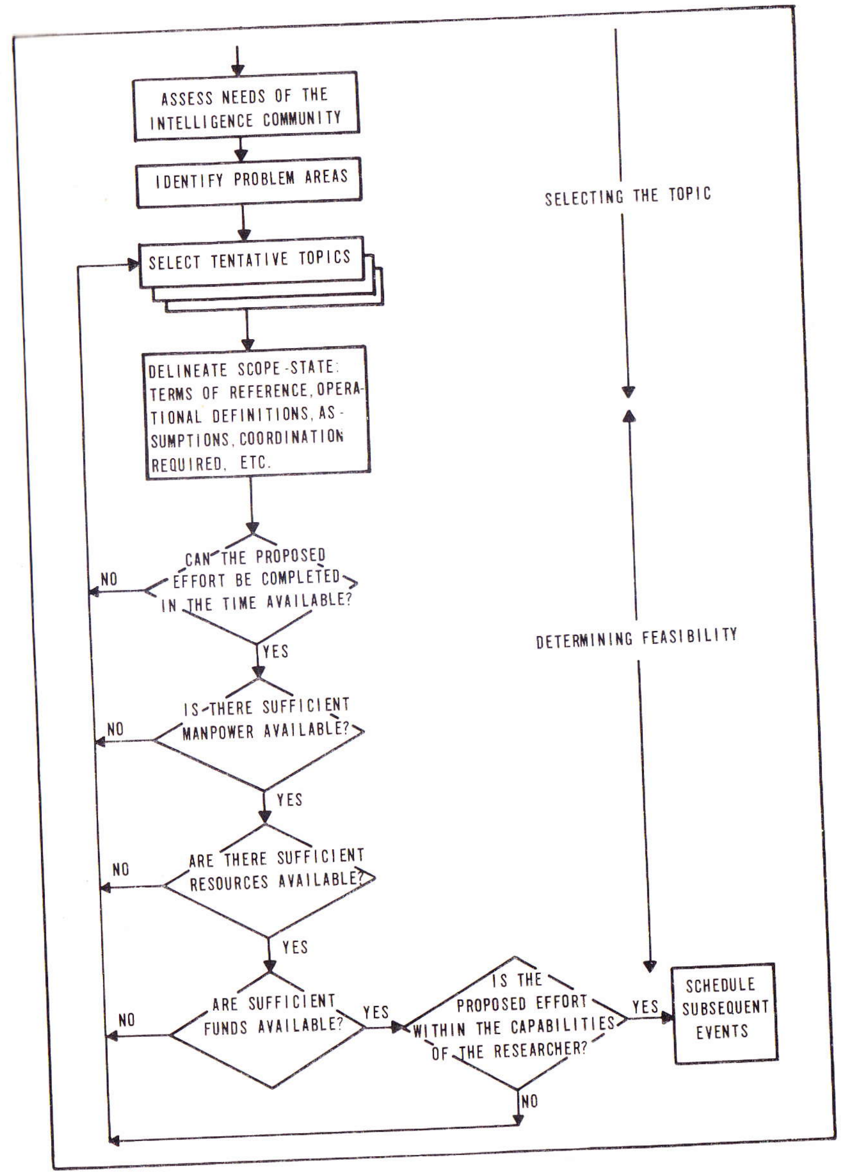

Figure IX-1. Steps in the Problem Definition Phase

Summary

▷Most research projects involve four phases: problem definition, data collection, data analysis, and report preparation. Planning is essential in all phases.

▷The problem definition phase of a research project involves two major functions: defining the problem and determining the feasibility of the approach that is proposed for attacking the problem.

▷Defining the problem involves considering the need for the study, delimiting the scope, defining terms of reference, and stating operational definitions.

▷Determining feasibility requires the researcher to consider the time he has available to complete his project, available manpower, available resources (such as sources of information), cost, as well as his personal capabilities and interests. These factors are interrelated. For example, data not immediately available may be expensive to acquire, take time, and require additional manpower. Additional manpower, in turn, may increase costs.

▷In self-initiated research projects, the researcher may further refine his topic throughout the problem definition, data collection, and analysis phases of his project.

▷The ultimate criterion in selecting a research topic is *need.* The ultimate criterion in determining if and how a research topic should be addressed is *feasibility*.

CHAPTER X
PLANNING THE RESEARCH PROGRAM—PART TWO: LOCATING SOURCES OF INFORMATION

Knowledge is of two kinds: we know a subject ourselves, or we know where we can find information upon it.

Samuel Johnson

In order to determine the nature and extent of the data collection activities to be performed, the researcher must know what data exist, and where and how data can be obtained. This chapter will discuss characteristics of various types of data, and places where data can be obtained.

Primary and Secondary Sources

Primary sources of information are *firsthand* observers, participants, or recorders. For example, a participant in a military operation would be a primary source, and any account he prepared pertaining to the operation, such as an after action report, would be a primary source document. An attache who observed a training exercise would be a primary source; so would an agent or a defector who made firsthand observations be a primary source. The outputs of various sensors (ELINT receivers, other receivers, radars, cameras, and scanners) are primary source data.

Secondary sources are documents prepared on the basis of primary sources. Thus, if an analyst prepared a report *based* upon evaluated information derived from interviews with agents or defectors, his document would be considered a secondary source.

Many researchers assume that primary sources or primary source documents are *necessarily* more reliable than secondary sources. This assumption is unwarranted. In evaluating any information, both the competency and the motivation of the

source must be taken into account. In certain instances observers are not competent to report what they observed. For example, an untrained observer might report an armored car as a tank, or a company-sized unit as a battalion.

Sometimes people see only what they want to see. For example, in World War II an enemy fighter plane downed while attacking a formation of bombers might be claimed as a "kill" by nearly every gunner in the bomber formation. Inflated estimates of enemy aircraft involved in a battle and inflated reports of the number of kills plagued intelligence organizations on both sides during World War II.

Motives of the writer must be taken into account when primary source documents are used. If a writer realizes that his personal records will be used by others he may deliberately portray himself in a favorable light. Even the most "candid" memoirs tend to be self-serving to some extent.

Researchers using statements made by prisoners of war must pay especially close attention to the motives of the source. Prisoners of war may lie or exaggerate in order to appease their captors, or to justify their behavior, or to deceive. During the Korean War, for example, Chinese Communist troops would permit themselves to be captured in order to organize other PW's detained in United Nations prison compounds. And it was not unusual for North Vietnamese Army (NVA) prisoners in Vietnam to report the favorable reception of U.S.-produced PSYOP leaflets in areas where none had been dropped. Rarely do prisoners give fear as a reason for surrendering, but instead cite ideological reasons, or lack of resources with which to fight as reasons for their capture.

People under stress are often poor observers or reporters (except of their own emotions, perhaps), and memories sometimes fail in recalling significant details. General S.L.A. Marshall found that descriptions by individual participants in battle were notoriously unreliable and that only by collating the

accounts of many participants could a valid picture of what actually occurred be constructed.[1]

Furthermore, cultural traits may impair the usefulness of primary sources. For example, in the Orient it is not unusual for a courteous respondent to report only what he thinks the researcher *wants* to hear, and for this reason it is sometimes necessary to devise a number of stratagems to corroborate various responses to a single question. In short, primary sources and primary source documents are not necessarily the best sources of reliable information.

Intentional and Unintentional Transmitters of Facts

In addition to being classified on the basis of source, research data may also be classified on the basis of whether or not the *medium* by which a fact is transmitted was created intentionally or unintentionally as a conveyor of information. "Intentional" transmitters of facts, according to Barzun and Graff, would include all records (both verbal and non-verbal). "Unintentional" transmitters of facts would include relics, such as remains, language, customs, tools and artifacts.[2] Interestingly, this listing of transmitters of historical facts has a corollary in intelligence. (Table X-1.)

The listing of intelligence transmitters of facts makes it clear that the researcher who limits his data only to printed

[1]The Late Cornelius Ryan, author of *The Longest Day*, *The Last Battle* and *A Bridge Too Far* (New York: Simon & Schuster, Inc.), used the same technique as Marshall, interviewing literally hundreds of participants in order to reconstruct an accurate account of what happened at Normandy, Berlin, and Arnhem, respectively.

[2]Barzun, *The Modern Researcher*, pp. 147-148. Strangely, Barzun and Graff classify letters, public documents, and business records as "unpremeditated transmitters of facts." Yet it seems that the only purpose for which most of these "relics" would be produced would be to record for later use an account of that which took place at the time the record was made.

Table X-1. Premeditated and Unpremeditated Transmitters of Facts

HISTORIGRAPHICAL TRANSMITTERS OF FACTS (BARZUN AND GRAF)	INTELLIGENCE TRANSMITTERS OF FACTS
RECORDS (INTENTIONAL TRANSMITTERS OF FACTS)	RECORDS (INTENTIONAL TRANSMITTERS OF FACTS)
1. CHRONICLES, ANNALS, BIOGRAPHIES, GENEALOGIES	1. OFFICIAL STATE HISTORIES, BIOGRAPHIES, GENEALOGIES (e.g., THE OFFICIAL BIOGRAPHY OF KIM II-SONG, HO CHI MINH, AND MAO TSE-TUNG; THE REVISED BIOGRAPHY OF STALIN.)
2. MEMOIRS, DIARIES	2. KHRUSHCHEV'S MEMOIRS; THE PENKOVSKY PAPERS; CAPTURED DIARIES OF PRISONERS; NON-FICTION NOVELS, e.g., THE GULAG ARCHIPELAGO.
3. CERTAIN KINDS OF INSCRIPTIONS	3. FACTORY MARKINGS ON MILITARY EQUIPMENT; INSIGNIA; PRINTED SLOGANS.
ORAL	ORAL
4. BALLADS, ANECDOTES, TALES, SAGAS	4. PATRIOTIC SONGS; PATRIOTIC SLOGANS; CHEERS; MOTTOES
5. PHONOGRAPHS AND TAPE RECORDINGS	5. RECORDINGS OF OPEN PROCEEDINGS OF CONGRESSES; SPEECHES OF THE LEADER; TRANSCRIPTIONS OF PRESS CONFERENCES
WORKS OF ART	WORKS OF ART
6. PORTRAITS, HISTORICAL PAINTINGS, SCENIC SCULPTURE, COINS AND MEDALS	6. STATE-COMMISSIONED DRAMAS, DANCES, MUSCIAL COMPOSITIONS; PAINTINGS AND STATUARY; NATIONAL SHRINES; TOMBS OF GREAT LEADERS, e.g., LENIN'S TOMB.
7. CERTAIN KINDS OF FILMS, KINESCOPE, ETC.	7. STATE PRODUCED RADIO AND TELEVISION DRAMATIZATIONS; PROPAGANDA FILMS, ETC.
RELICS (UNPREMEDITATED TRANSMITTERS OF FACTS)	RELICS (UNPREMEDITATED TRANSMITTERS OF FACTS)*
8. HUMAN REMAINS, LETTERS, LITERATURE, PUBLIC DOCUMENTS, BUSINESS RECORDS	8. INTERCEPTED CORRESPONDENCE AND OTHER COMMUNICATION; CAPTURED PLANS, ORDERS AND REPORTS; BILLS OF SALE; SHIPPING DOCUMENTS; PRODUCTION FIGURES; BUDGETS; ORGANIZATION CHARTS.
9. LANGUAGE, CUSTOMS, AND INSTITUTIONS	9. CREATION OF NEW WORDS (TECHNICAL VOCABULARY); CAREFUL AND SELECTED USE OF DIPLOMATIC LANGUAGE; ATTEMPTS TO EXPUNGE THE WORKS OF EARLIER SPOKESMEN.
10. TOOLS AND OTHER ARTIFACTS	10. CAPTURED WEAPONARY, UNIFORMS AND EQUIPMENT

* TO THE LIST OF UNPREMEDITATED TRANSMITTERS OF INTELLIGENCE FACTS SHOULD BE ADDED RADIATIONS AND EMISSIONS; e.g., LIGHT, ELECTROMAGNETIC RADIATIONS, HEAT (IR), PARTICLES, ACOUSTIC, AND SEISMIC.

documentation is overlooking other potentially valuable types of input. Admittedly, nondocumentary input must be transformed into some documentary form before it can be used, and formatting and structuring of the data may be necessary. But even when large amounts of printed data are used, the data must also be formatted for ease in tabulation or interpretation and analysis.

Data Sources and Potential for Bias

Concern for bias should enter into the researcher's selection of any type of data. Bias may be of two types: that which is inherent in the data, and that which may be introduced by the researcher. One would anticipate, for example, that intentional transmitters of facts would very likely contain bias introduced by their author or creator. Biographies of Premier Kim Il-song deliberately confuse the details of his birth and imply that he and the legendary hero of Kim Il-song are one and the same. Similarly, biographies of President Park Chung Hee treat very cursorily Park's military training in the Japanese Army. Even purportedly "objective" documents may be biased; for example, field reports sent to higher headquarters by the Japanese in World War II often contained fantastic claims of success, and the Japanese high command became a victim of its own propaganda.[3]

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[3]Morison states that the Japanese Navy section of the Imperial General Headquarters accepted their pilots' reports of U.S. losses at face value, and issued a communique, prior to the invasion of Leyte, that U.S. Third Fleet losses included eleven carriers, two battleships, three cruisers, and one destroyer. In addition, eight carriers, two battleships, four cruisers, and thirteen unidentified other ships were reported as damaged and set afire. Although Japanese naval officers said after the war that they did not believe these claims, the Army section of the Imperial General Headquarters did believe them, and had begun to modify the defense plans of the Philippines accordingly. Samuel Eliot Morison, *History of United States Naval Operations in World War II*, vol. XII: *Leyte, June 1944-January 1945*. (Boston: Little, Brown and Company, 1961), pp. 108-109.

But researchers often fail to take into account the bias they may introduce themselves. As mentioned earlier, inexperienced researchers categorically reject as "mere propaganda" any statement carried over state-controlled broadcasting systems. For instance, broadcasts from mainland China and from North Korea have alluded to industrial production problems and to instances of internal dissent. And in the case of China, often these references were precursors to major changes in the party or military hierarchy.[4]

One of the major sources of researcher-introduced bias involves the manner in which the researcher selects and analyzes his data. For example, he may limit his input only to one source and thus exclude other potentially valuable collateral information. He may be unsystematic in his selection and collection of data, or he may use analysis techniques that are inappropriate for his data.

For example, one of the authors noted that propaganda analysts were performing statistical analyses of North Korean propaganda when the initial assumptions of the statistics were not satisfied. Frequency counts, means, and standard deviations were calculated on data that were not obtained in any systematic manner. The analyses were based on daily takes provided by Foreign Broadcast Information Service (FBIS). As useful as the FBIS output may have been, in order to perform the statistical analyses of the kinds just mentioned, the data had to be obtained from the same source, at the same times, for a specified period. However, in the case just cited, data were collected only when it appeared that something worthwhile would be obtained. As will be discussed in later chapters, even "random" sampling must be done systematically if any meaningful statistical analyses are to be performed on the data.

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[4]Interestingly, a two-page advertisement in *The New York Times* (16 March 1975) paid for by the Information Section of the Office of the Permanent Observer of the Democratic People's Republic of Korea, mentioned the existence of a black market and a "peasant market" in the otherwise utopian socialist society of North Korea.

Anticipating the existence of bias permits the researcher to take appropriate safeguards, and at the minimum, to treat his data with skepticism. Much harder to anticipate are potential biases inherent in the researcher himself, particularly cultural biases which not only affect the way a researcher may feel, but which may also affect the manner in which a researcher actually perceives reality.[5] One method of possibly reducing the effects of bias is to use a variety of sources as rigorously and as systematically as possible.

Sources of Research Data: People, Objects, Emanations, and Records

Sources of research data may be *people, objects, emanations,* and *records*. As mentioned earlier, the sources may be primary or secondary. Regardless of the nature of the source, all data from all types of sources must be transformed ultimately into some symbolic form, typically words or numbers.

People

Human sources of research data may be subject matter specialists, or they may be "information specialists." Examples of subject matter specialists would be analysts at various desks in the different government agencies, journalists, scientists and engineers (employed by the U.S. Government, or under contract), scholars, emigres, defectors, eye witnesses, or participants (in an event, a movement, an organization, or an operation). These specialists can help the researcher by providing substantive answers to specific questions, and by indicating additional sources of information. These additional sources could be other human sources or documentary sources.

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[5]Benjamin Lee Whorf's, "The Relation of Habitual Thought and Behavior to Language,"is a masterpiece in this respect. The essay discusses the effects of language, one of the more profound manifestations of culture, on perception. The essay can be found in Leslie Spier, ed., *Language, Culture and Personality: Essays in Memory of Edward Sapir* (Manasha, Wisconsin: Sapir Memorial Fund, 1941).

Sometimes the human sources of data are also the subject of the research. For example, the former KGB agents interviewed by John Barron for his book, *KGB: The Secret Work of Soviet Secret Agents,*[6] were both primary sources of information about the KGB's organization and operations, as well as the primary subjects of the book.

Analysts, scholars, or journalists who specialize in certain subject matter areas know the literature in their field and they can save the investigator many hours of searching by indicating the best or most recent literature relating to the researcher's needs. When time is critical, this preliminary literature screening is invaluable.

But for increasing research *efficiency,* the information specialist excels. Information specialists are those who are intimately familiar with the holdings of various repositories and who are trained in the techniques of retrieving information. Information specialists include those whose tasks include procuring, cataloging, and retrieving documents (i.e., "librarians", in the traditional sense), and those who specialize in retrieving data from automated systems.

These resource personnel can assist the researcher, again, by indicating likely sources of information, but equally important, by helping the researcher devise efficient search strategies. For example, the librarian can identify indexes relating to various subjects, and use of these indexes can save the researcher many hours of poring through card catalogs. The librarian may also be able to identify special holdings, e.g., certain kinds of classified information, or private or public collections of works relating to a specific topic and again save the researcher time. Data processing experts can help the researcher formulate queries for

[6]John Barron, *KGB: The Secret Work of Soviet Secret Agents* (New York: Reader's Digest Press, 1974).

machine processing so that the response is tailored to the researcher's specific requirements.[7]

Not to be overlooked are research assistants. Admittedly, research assistants may not be available for student use, but major commands and the larger intelligence organizations may have personnel available who are well-trained in gathering documentation from various libraries and other repositories. Conceivably, if a research project warranted it, and if the proper approval had been obtained, the assistance of the Congressional Research Service of The Library of Congress might be employed.

In essence, the "holdings" of any library are increased significantly by the ability to obtain materials through interlibrary loans or by the ability to tap other automated data bases from remote terminals. Again, by using these services and facilities, the researcher saves time and money and is spared inconvenience.

In addition to procuring documents (including maps and charts), providing general research and bibliographic assistance, and alerting researchers to new acquisitions, the DIA Library personnel (specifically, personnel from the Translation Branch of the Central Reference Division) can also provide in-house translation service in eight languages.[8]

Finally, with their knowledge of the magnitude (or paucity) of available data, their familiarity with what has been done in the past, and their knowledge of problems encountered in

[7]A DIA analyst queried his system for information relating to underground structures. Unfortunately, the "structure" part of the query was not made clear, and the machine "dumped" everything relating to underground organizations, the French Maquis, guerrilla warfare, unconventional warfare, and so on, since World War II.

[8]French, German, Romanian, Italian, Portuguese, Spanish, and Russian.

similar or related efforts, information specialists can also provide assistance to the researcher in determining the feasibility of a self-initiated research project.

Objects

Objects are more often the subject of research than they are a source of research information. However, the characteristics of an object may suggest something about its origin and intended use and in this sense an object is at least a source of inferences if not an actual transmitter of facts. A change in the composition of a piece of personal equipment, for example, may indicate a shortage of certain materials; a change in quality or design sophistication may indicate a lack of sufficiently trained production personnel; the absence of certain equipment on later models may indicate that problems were encountered with the equipment on earlier models; and machine stampings indicate the country which produced the item.

In intelligence research the objects of concern are weapons, weapon platforms, and equipment—configurations, navigational, logistical, medical, transportation, and personal. Unless the intelligence researcher is technically competent to "exploit" a piece of equipment himself, he will require assistance from other human sources. Where appropriate resource personnel could be located would depend upon the service to which the piece of equipment would be of primary concern. For example, the Naval Intelligence Support Center (NISC) at Suitland, Maryland, would be an appropriate place to locate experts in foreign naval equipment; the Foreign Science and Technology Center (FSTC) at Charlottesville, Virginia, would be an appropriate place for expert information on army materiel, and the Foreign Technology Division at Wright Patterson Air Force Base in Dayton, Ohio, could provide assistance relating to aircraft, avionics and electronics.

For information relating to missiles, the Army's Missile Intelligence Agency (MIA) in Huntsville, Alabama, would be a plausible source (depending upon the type of missile); and information relating to medical equipment and practices could

be obtained from the Army's Medical Intelligence and Information Agency (MIIA) in Washington, D.C.

Equipment specialists in various branches of the Army could also provide consultative assistance. Locations of possible resource personnel in various technical areas include: Aberdeen Proving Ground, Aberdeen, Maryland, ordnance; Ft. Lee, Virginia, quartermaster materiel; Ft. Belvoir, Virginia, engineering equipment; Ft. Eustis, Virginia, transportation equipment; and Ft. Monmouth, New Jersey, and Ft. Huachuca, Arizona, signal communication equipment and electronic equipment.

Additional expertise in scientific intelligence, electronics, and foreign missiles and space activities can be found within the Directorate of Science and Technology of CIA. However, these areas tend to be highly sensitive, and appropriate clearances and need to know must be established before these human resources can be used.

Exactly where to go for what type of assistance is difficult to spell out. For example, a fire direction radar on an antiaircraft weapon might be considered the purview of the Air Force, whereas a radar used for battlefield surveillance would be of primary interest to Army electronics specialists. Furthermore, one technical intelligence organization may be concerned only with selected aspects of a piece of equipment. For example, the physical features of communication equipment would be of interest to specialists at Ft. Monmouth, but the signal characteristics would be examined at Ft. Huachuca.

Coordination with the appropriate agencies must follow established chains of command. Agency liaison and service personnel at the Defense Intelligence School can provide guidance in coordinating contacts with the various agencies. Information for coordinating visits can be obtained directly from the agencies or organizations to be visited.

Emanations

Emanations refer to those detectable phenomena given off or radiated by natural or man-made objects. Since virtually every war-making device gives off certain emanations, the detection and classification of these phenomena are critical to the intelligence community. Emanations are essentially bias free. But bias may be introduced when the human attempts to give meaning to a specific radiation or emanation.

Emanations are unintentional and unpremeditated transmitters of facts, and adversaries often go to great pains to reduce or eliminate them. For example, in the early part of World War II, the German navy began to sustain very high losses in its submarine fleet. Convinced that British airborne radars were detecting waves that were re-radiated from the submarines' receivers, the Germans curtailed the use of the receivers. But the casualties continued to mount because the British had developed microwave radars whose signals could not be detected by German receivers even had they continued to have been used. The fact that British radars operated on frequencies and power output unknown to the Germans forced the Germans to develop methods by which subs could remain submerged, and this gave impetus to the development of the "snorkel", a device that permitted submarines to recharge their batteries without surfacing.[9]

Data about emanations are obtained from the outputs of various sensors, and the type of sensor determines the nature of the output. For example, the output may take the form of imagery ("photographic", infrared, or multi-spectral) or magnetic tapes. Exploitation of these data requires highly specialized skills. Furthermore, before the data can be used by the

[9]Jerome A. O'Connell, U.S. Navy, "Radar and the U-Boat," *United States Naval Institute Proceedings* 89 (September, 1963): 53-65. This anecdote also illustrates the dangers of faulty assumptions. German electronic specialists assumed that since they had not been able to develop radars in certain frequencies, neither could the Allies.

non-technical analyst or researcher, they must be converted into another form, usually verbal or pictorial.[10] Collection and analysis of emanations constitute some of the most highly classified operations of the intelligence community. Access to these data requires special clearances.

Records

Records exist in symbolic and non-symbolic forms. Symbolic forms of records include all verbal reports (written and oral, e.g., tape-recorded interviews) and numerical tabulations. Non-symbolic forms of data include photographs (without annotations) and outputs of other sensors which are usually contained on magnetic tape. Until the non-symbolic forms of records are converted to some symbolic form, they must be considered as "raw", unevaluated data. Even many of the symbolic records at the disposal of the intelligence researcher are raw data; for example, the unevaluated intelligence reports.

Using non-symbolic raw data requires a high degree of specialized technical training, and separate organizations have been created specifically for exploiting these types of data; for example, the National Photographic Interpretation Center (NPIC), and the National Security Agency (NSA). Unless the researcher has the appropriate training and skills necessary to work with raw non-symbolic data, he is advised not to attempt to use them.

Raw *symbolic* data are a different matter. Use of these data requires only the skills that all researchers should have developed—skills in establishing the credibility of the source, and the plausibility of the contents.

Evaluated symbolic data constitute the bulk of the materials with which most researchers work. These data are stored in libraries, "archives", respositories, and data bases. Where one

[10]Infrared (and other) imagery may be converted to digital data for certain types of analysis, then back into some pictorial form for other types of analysis.

goes for the data depends upon the data required, as mentioned earlier, but the initial point of contact for students of the Defense Intelligence School is the School Librarian.

The Researcher's Essential Elements of Information (EEI's)

Initial contacts with librarians usually take the form of a dialog in which the librarian attempts to determine as precisely as possible the researcher's needs. In the process of this discussion certain questions are addressed. These questions and their implications are discussed below.

Question

1. Is the information needed likely to be classified?

Implication

Classified data will require the use of Government agencies' holdings. Consequently, the number of potential repositories is limited. Determining security classification also indicates which sections of an agency's library should be examined; for example, the unclassified, classified, or special sections of the Defense Intelligence School Library. The determination of classification also indicates to the researcher what security clearances he must hold to gain access to these data.

Question

2. What agency or department (university, research facility or organization) would be a logical source of the required information?

Implication

This determination is useful for establishing initial contacts with resource personnel, as well as for locating printed materials. *Library and Reference Facilities in the Area of the District of Columbia*, Mildred Benton, ed., (Washington, D.C.: The Joint Venture) is very useful for this purpose.

Question

3. Is the information required considered to be of a "current" nature or of an "historical" nature?

Implication

For information pertaining to current or recent events one would normally search periodicals, monographs, newspapers and current intelligence reports as well as indexes of periodic literature; e.g., the *Readers' Guide to Periodical Literature* and *The New York Times Index*. For "historical" information (events *at least* six months old), books, basic intelligence documents and indexes to these documents would also be examined. Normally, "scholarly" books require at least a year from concept to publication; however, publishers can sometimes produce books in surprisingly short times; e.g., the Government Printing Office's publication of the Watergate tape transcriptions in a matter of days. The *Subject Guide to Books in Print* can be helpful for locating "historical" information.

Question

4. Are there bibliographies or indexes relating to the subject matter?

Implication

Screening these documents may save time, money, and travel. The listings indicate what is available, and sometimes where the information is stored. Bibliographies also indicate who is contributing to the field. (See item #7.) A valuable index is the *Air University Index to Military Periodicals.*

Question

5. Does the information needed exist in any abstracted form?

Implication

The Defense Documentation Center (DDC), at Cameron Station, Alexandria, Virginia, has abstracts of thousands of documents prepared for official use by government and

contractor personnel. Abstracts can also be obtained from the National Technical Information Center (NTIC) at Springfield, Virginia. Abstracts of books, periodicals, translations, evaluated and unevaluated intelligence reports on scientific and technical subjects can be obtained via the CIRCOL System (Central Information Reference and Control On-Line) and the CIRC II System. Abstracts of articles from some sixty periodicals as well as from *The New York Times* can be obtained from The New York Times Information Bank.

Question

6. How soon is the information required?

Implication

This information is necessary to make tradeoffs between the best sources possible and most immediate sources available.

Question

7. Who are the authorities in the fields?

Implication

Knowledge of authorities permits data searches on the basis of author. This expedites reviews of literature. Authorities are also potential resource personnel as well.

Question

8. What are the basic reference works in the field?

Implication

Basic reference works exist for nearly every discipline. Many of these references contain substantive data; for example, *Who's Who,* (and the various international versions thereof); various encyclopedias (of world history, or American history); handbooks; yearbooks; and so on. Basic works also often contain bibliographies. In addition to basic works, attention should be paid to the more prestigious journals in the respective disciplines. These journals often publish indexes annually. Journals also help identify authorities in the field.

Question

9. Where are the resources located?

Implication

Locations of human sources can be determined often from the sources in which they publish. Locations of collections of published materials can be inferred, in part, by the nature of the document (e.g., periodical, book or monograph), by the subject matter addressed, and by accession lists and catalogs.

Having identified the kinds of data required and the locations or repositories of data, having identified key personnel to be consulted, and having assessed the quantity of data available, the researcher is ready to conclude the planning phase of his research program. The conclusion of the planning phase involves specifying the activities to be performed, determining the sequence in which they are to be performed, and allocating time for each activity. These steps will be discussed in the next chapter.

Summary

▷ Knowledge of real or potential sources of data is essential for project planning purposes. The nature and extent of the subsequent data collection effort will depend upon the availability of sources.

▷ Sources are classified as *primary* or *secondary*. A *primary* source would be a firsthand observer, participant, or recorder of an event or activity. A *secondary* source is a document prepared on the basis of a primary source. Primary sources are not necessarily better than secondary sources, because some firsthand observers or participants may be poor observers, may be poor recorders, and may deliberately report only that which tends to reflect most favorably on themselves.

▷ Data or information may be classified also on the basis of whether or not the *medium* by which a fact is transmitted was created *intentionally* or *unintentionally*. Examples of intentional transmitters of facts would be diaries, chronicles, and annals. Examples of unintentional transmitters of facts would be customs, tools, relics, and artifacts.

▷ The concern for possible bias should be taken into account when selecting sources of data. Bias may be inherent in the data, or may be introduced inadvertently by the researcher.

▷ Sources of research data include *people, objects, emanations,* and *records.*

▷ The researcher's tasks in the planning (or problem definition) phase are to determine what kinds of data he needs, who or what are the best sources of these data, and where the data are located.

▷ For archival data, the librarian can provide invaluable assistance. In addition to actually procuring needed reference material, the librarian can also assist the researcher by helping him define his data requirements more precisely.

CHAPTER XI
PLANNING THE RESEARCH PROGRAM—PART THREE: SCHEDULING THE ACTIVITIES

Most people spend ninety percent of their research time chasing the last, elusive ten percent of the information they use.

Charles Jacobs

By the time the researcher defines his problem and identifies his sources of information, the temptation to start data collection immediately is a strong one. The intelligence researcher who has "gone through the mill", however, realizes that time spent scheduling the subsequent events will pay off well in anticipating technical problems, in anticipating administrative problems and delays, and in making clear to himself (and to his supervisor or adviser) what tasks must be accomplished in what order. In short, planning is a method for ensuring that the activities will be conducted in the most efficient manner.

This chapter describes major factors that should be considered in scheduling a research program. Sections of this chapter, particularly those dealing with methodology, are expanded in later chapters. Obviously, the nature of the research will dictate the specific steps that must be undertaken in each type of research project, and no single plan of attack or schedule will satisfy every requirement. However, requirements of all research projects can be addressed at a general level. These general requirements are the framework for identifying additional requirements unique to any specific research project.

Factors to Consider in Planning Data Collection

Factors to consider in planning the data collection phase of the research project relate to *sources* of data, to the methods required for *obtaining* or *extracting* the data, and to the

logistics and *coordination* required to gain access to the data. In planning the data collection phase, the researcher should ask these questions:

Sources

Do the data exist, or must they be "generated", i.e., collected from primary sources or by firsthand observation?

Who or what are the sources of data? For example, will primary or secondary sources be used? Are the sources human, documentary, or in some other form of record?

Will any transformation of the data be required (e.g. from magnetic tape to a printed page)?

Where are the data located (e.g., at U.S. Government facilities, private or state-supported institutions, in data "banks", libraries, archives, etc.)?

How can the data be used or obtained? Must they be used at another facility? Can they be borrowed? Do they require special facilities for utilization such as microfiche readers or other display devices?

What are the *priorities* for locating and obtaining data?

Obtaining data

Will the data be collected from whole populations or from representative samples of larger populations? Will a poll or survey be required?

If samples of larger populations are to be tapped, what method will be used for collecting data: personal interviews, mail questionnaires?

How will the sample be constructed?

What size will the sample be?

What measurement devices will be used (e.g., questionnaires, rating scales, etc.)?

Are the measurement devices "off the shelf" items, or must they be constructed?

If the devices are to be constructed, have provisions been made to validate them?

Have the measurement devices (survey instruments, recording formats, etc.) been pilot tested?

What types of forms should be used for recording data (other than interview schedules and questionnaires)?

Can the data be pre-formatted for ease in later analysis?

Will any special equipment be required to collect the data (e.g., tape recorders, cameras, etc.)?

If other people will assist in data collection, will training be required (e.g., dry runs, practice sessions)?

Logistics and coordination

How will first contacts be made? In person, by telephone, by letter?

Will approval from higher authorities be required before visiting sources or repositories of data?

By what means is the approval obtained?

Are there any protocol considerations to take into account?

Will travel be required? If so, by what means? How much funding will be required? By whom will the funds be provided?

With respect to travel, are there any special requirements such as passports, visas, or immunization?

Will clearances be required or must need to know be established?

Who are the contact points of the agency to be visited?

Must any documents such as form letters, questionnaires, or other data collection formats be printed or reproduced for the data collection effort? If so, by what means, where, and by whom will they be prepared?

Factors to Consider in Planning Data Analysis

In nearly every type of research, data analysis can (and should) begin as soon as the first piece of information is collected. Therefore, in the planning stages, attention should be paid to the manner in which the data are to be collated and processed once they are obtained. Regardless of the nature of the research, the analysis phase always requires *collation*. Collation may involve comparing the contents of various documents, relating the contents of documents to maps or charts, or collation may simply involve ordering data chronologically, or topically, or by subject or author. Sometimes collation is performed only on the "externals" of the data; for example, on the author, date, subject, and place of publication.[1] Again, the nature of the collation (and the analysis) to be performed will be determined by the nature of the research problem. Various kinds of analytic operations that can be performed on data will be discussed in more detail in later chapters, but at the planning stage, attention should be paid to the following factors:

Has a data storage and retrieval system been established? (Systems can range from a 3 x 5 card file to a computer's data base.)

Are there secure places for storing data (if the data are classified)?

Will any data reduction be required? For example, will there be large amounts of statistical data to be taken off questionnaires or rating scales and tabulated by categories?

[1]"Collation" requires better definition. For some analysts, collation relates only to the process of bringing together the information or organizing and cataloging the data. To other analysts and researchers, the term collation is tantamount to the whole analytic process. In the sense that the term is used in this chapter, collation refers to the process of ordering, indexing, and organizing information prior to further analysis and synthesis.

Will data processing equipment be required? If so, what kinds will be required, where will they be available, and how much computer or machine time will be required?

How much lead time will be required to schedule equipment?

What special research aids will be required; e.g., maps, charts, photographs, atlases, gazetteers, and so on?

Will basic reference documents such as statistical handbooks and biographic registers be available when they are needed? Is there sufficient lead time to order them?

Do algorithms or models exist, or must they be developed before the data can be used?

Are hypotheses formulated to a degree of specificity so that analysis can proceed?

Will personnel with specialized skills be required (e.g., key punch operators, programmers, photo interpreters, or consultants)? How much advance notification will these people require?

Will all of the personnel required to analyze the data have appropriate clearances?

Factors to Consider in Planning Report Preparation

Because report preparation is the last phase to be completed, it is typically the phase that is shortchanged most often in terms of insufficient time, funds, manpower, or resources. This is unfortunate. The report preparation phase is the culmination of the entire project; furthermore, the product of this phase represents the only tangible evidence of the effort expended over weeks, months, and perhaps years. Unfortunately, by the time this phase is reached, the researcher has very little flexibility for re-programming. He is committed to decisions made during the earlier phases. It is for this reason that the researcher must pay particular attention to the following factors:

What format should be used? (Assigned projects usually require adherence to an established format; self-initiated projects often permit the researcher to establish his format. Institutional requirements must be considered.)

How long will the report be?

For what purpose will the product be used? For general information, for policy planning, for decision making in a very specific context?

Who will the readers be? Will the report be read primarily by highly trained specialists in the field or by "generalists"?

Will the outline prepared during the problem definition step suffice? Must it be modified or rewritten completely?

How detailed should the report be?

Will "art work" be required; e.g., statistical tables, illustrations?

How much lead time will be required for preparing the art work? Who will do it? Where will it be done? How much will it cost? How long will it take?

Will photographs be included? If so, where or how will they be obtained?

How much time will be required to produce the first draft?

Who will edit the report? How long will the editorial review take? Will there be time for revision?

How much time will be required for final printing?

Are there any special format or stylistic requirements pertaining to footnoting, use of special terminology, bibliographies, or layout?

Are there basic reference books on style and usage available?

Work Breakdown Structure: The First Cut at Scheduling

Regardless of the complexity of the project, it would be well for the researcher to prepare a *work breakdown structure* as an aid in identifying what tasks must be accomplished in what sequence. Preparing a work breakdown structure involves breaking down the overall project into a series of smaller, more manageable tasks. The subdivision of a project into tasks continues until the desired level of detail is reached. In highly complex projects that involve many steps and require the coordination of other workers or equipment, the work breakdown structure may have three or four levels of complexity. For a one-man project that is fairly uncomplicated, a two-level breakdown may suffice. A work breakdown structure for the data collection phase of a project might look like this:

DATA COLLECTION PHASE

First Level:

REVIEW LITERATURE (Task 2)	INTERVIEW KEY PERSONNEL (Task 3)

Second Level:

2.1 REVIEW UNCLASSIFIED PERIODICALS	3.1 IDENTIFY KEY PERSONNEL
2.2 REVIEW CLASSIFIED DOCUMENTS	3.2 COORDINATE VISITS
2.3 REVIEW UNCLASSIFIED BASIC WORKS	3.3 CONDUCT INTERVIEWS

For more precise planning, the researcher could break down each task into further steps, for example:

2.1 REVIEW UNCLASSIFIED PERIODICALS FROM —— TO ———

2.1.1 CHECK INDEXES/ABSTRACTS
2.1.2 SURVEY DATA BASES

2.2 REVIEW CLASSIFIED HOLDINGS

2.2.1 CLASSIFIED PERIODICALS FROM —— TO —— .
2.2.2 CLASSIFIED BASIC SOURCES (e.g., NIS's . . latest date)

2.3 REVIEW UNCLASSIFIED "BASIC WORKS"

2.3.1 INHOUSE DOCUMENTS
2.3.2 LIBRARY OF CONGRESS
2.3.3 STATE DEPARTMENT LIBRARY

3.1 IDENTIFY KEY PERSONNEL

3.1.1 U.S. DOD PERSONNEL (e.g., defense attaches)
3.1.2 U.S. STATE DEPARTMENT PERSONNEL
3.1.3 DIA ANALYSTS
3.1.4 CIA ANALYSTS

3.2 COORDINATE VISITS

3.2.1 LOCATE KEY PERSONNEL
3.2.2 CLEAR VISITS WITH APPROPRIATE AUTHORITIES (for foreign nationals, e.g.)
3.2.3 MAKE INITIAL CONTACTS WITH KEY PERSONNEL
3.2.4 SEND CLEARANCES
3.2.5 PREPARE INTERVIEW SCHEDULE OR QUESTIONNAIRES
3.2.6 REQUEST TRAVEL AUTHORIZATION AND FUNDS

3.3 CONDUCT INTERVIEWS

3.3.1 WRITE UP RESULTS OF INTERVIEWS
3.3.2 FOLLOW-UP INTERVIEWS IF NECESSARY

Plotting Activities on a Time Line: The Second Cut at Scheduling

Having identified the tasks to be performed, having identified the tasks upon which subsequent tasks are based, and having estimated the time required to complete each task, the researcher should plot the activities along a time line. The time line shows the amount of time available to complete the project. At this step it is helpful to *work backward* from the date by which the project must be completed. The first plot might look like this one shown in Figure XI-1.

Obviously, in the example just shown the researcher would not have enough time to complete the project in the manner he depicted. In instances such as this, the researcher might examine his topic and further delineate the topic, or request additional time or manpower. But the plan as shown is not very realistic. For instance, the plan shows that no subsequent task will be started until a prior one had been completed. This is not efficient planning, and it leaves very little room for error.

A more realistic and efficient plan is shown in Figure XI-2. In this plan, data collection begins before the problem definition phase ends. This is not unrealistic. Although some refinements may be made in the definition of the problem as the project progresses, it is unlikely that the entire problem would change. Therefore it would be to the researcher's advantage to begin data collection as soon as possible. Furthermore, there is no reason why analysis cannot begin as soon as data become available. Finally, report preparation can begin while the data are still being analyzed. Every research report contains a certain amount of "boiler plate" material—introductory material relating to the statement of the problem, assumptions and hypotheses, methods used, and often, reviews of literature. These portions of the report can be prepared before all of the data are collected and analyzed.

By overlapping the tasks, the researcher can optimize his time and manpower utilization. Furthermore, the sooner tasks

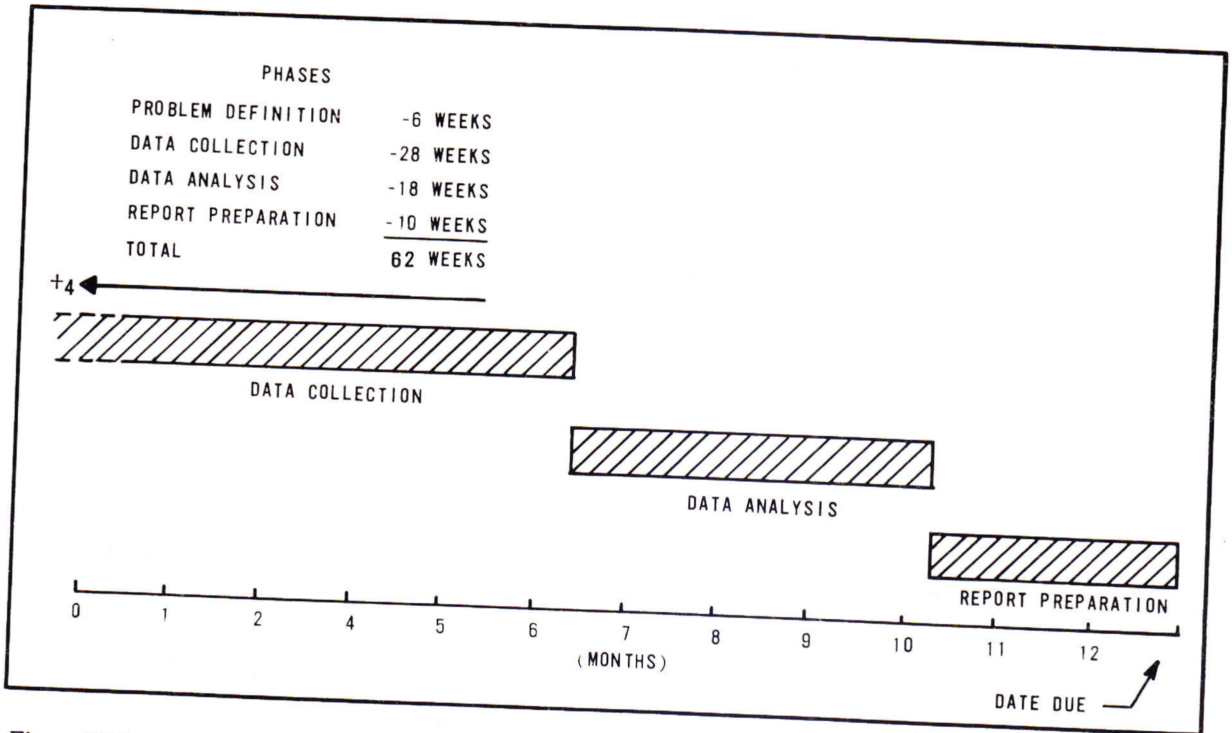

Figure XI-1. Phases of a Project Plotted on a Time Line, Working Backward From the Date Due (First Plot.)

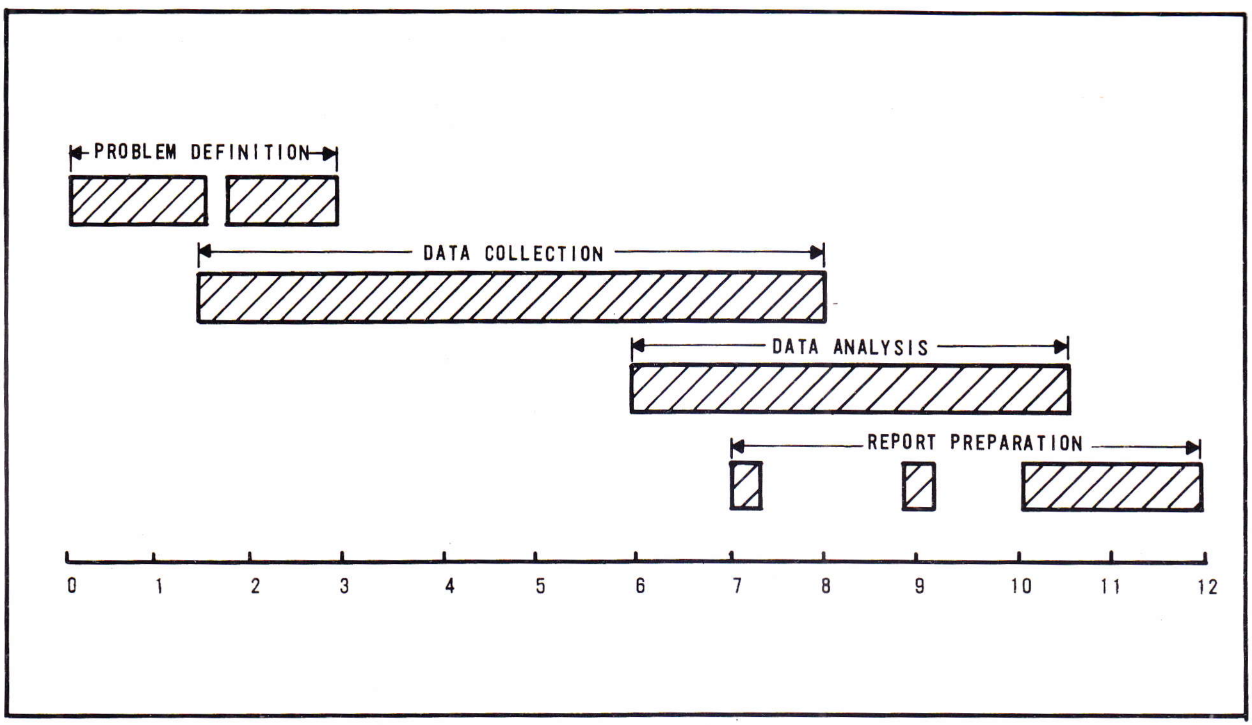

Figure XI-2. Phases of a Project Plotted on a Time Line, (Revised.)

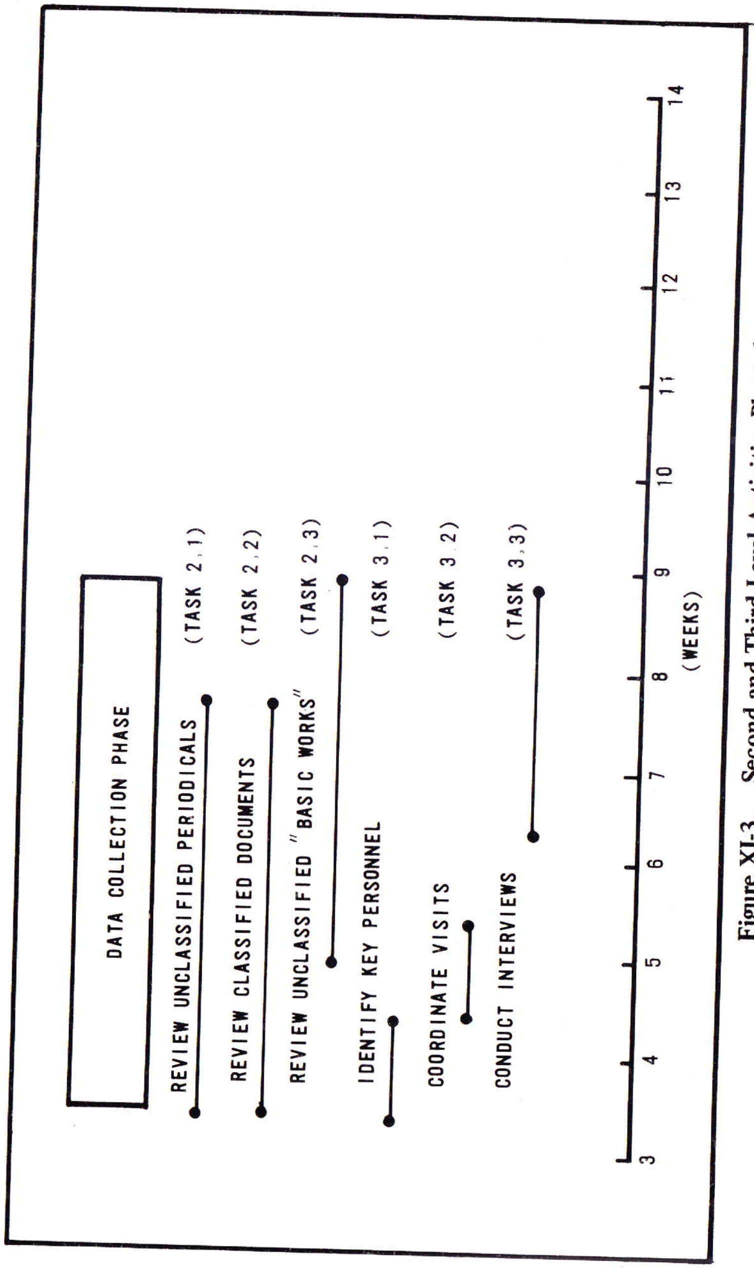

Figure XI-3. Second and Third-Level Activities Plotted on a Time Line.

are started, the sooner problems become apparent. And the sooner a problem is identified, the greater are the chances of solving it within the time available.

Having blocked out the major phases of the project, the researcher is ready to examine more closely each specific phase. Again, for greater specificity, the researcher might want to schedule second or third level events. Considering only the data collection phase, his schedule might look like this (Figure XI-3):

Use of Networks in Planning Complex Programs

Research projects that involve several researchers and many operations, some of which are dependent upon others, may be sufficiently complex to warrant more detailed planning. In these cases, it may be helpful to prepare a *network* of activities and events for each major task of each phase, and then prepare a master network showing the relationship of each task to the overall effort.

One way of preparing a network is to make a flow diagram of the activities to be performed. A simple flow diagram of the data collection phase of a project is shown in Figure XI-4.

Another way of constructing a network is to depict graphically all of the tasks on the work breakdown structure by using a "bubble" to represent the start or the termination of an activity and a line with an arrow to represent the activity itself. Figure XI-5 is a network of the interview portion of the data collection phase discussed previously.[2]

[2]In this example, the "bubble" indicates the start of an activity. The start of an activity is an "event." Whether "bubbles" indicate the initiation or the termination of an activity is up to the planner, but the use must be consistent.

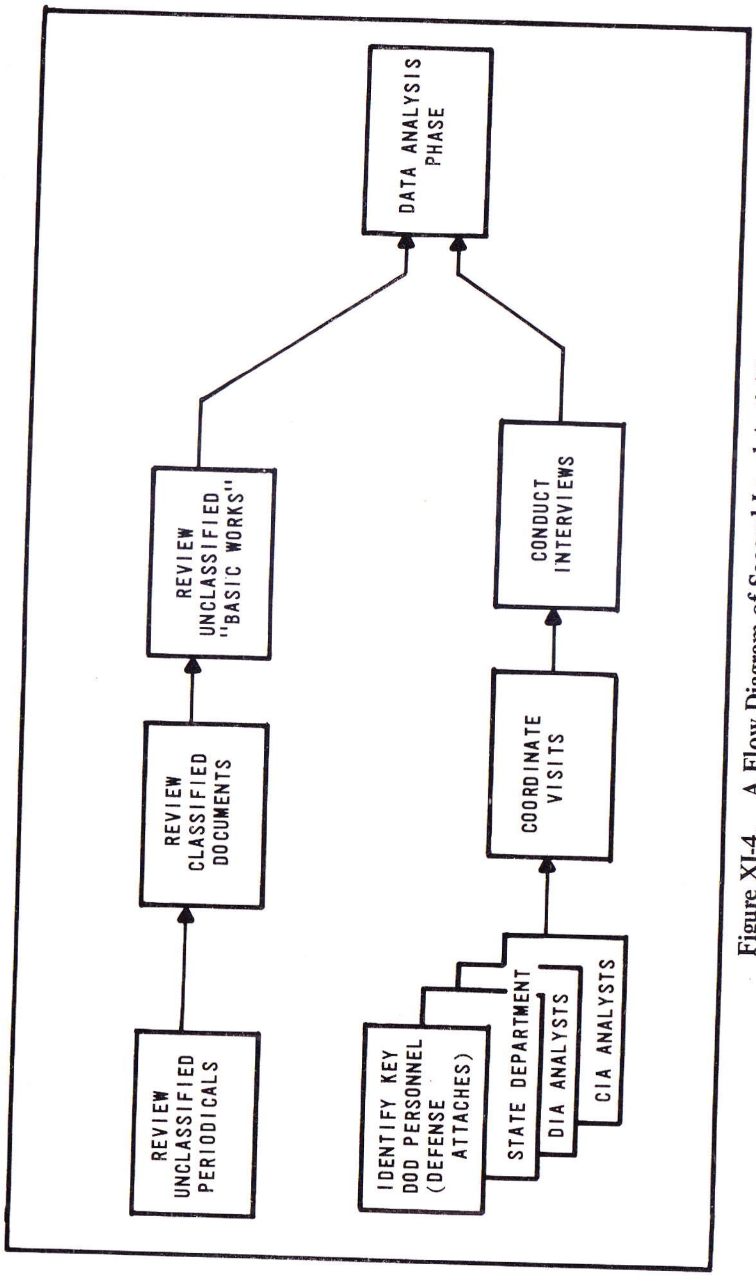

Figure XI-4. A Flow Diagram of Second-Level Activities in the Data Collection Phase

This format is especially useful for showing dependencies, i.e., identifying those activities which must precede others; for identifying activities that can be performed simultaneously and for identifying critical events which, if not accomplished, could jeopardize the successful completion of the project. This network plot is not only a planning device, but it is also a useful device for measuring progress. Scheduling events in this manner is called *PERT* (for Program Evaluation and Review Technique), and in its most complex form involves making three time estimates for completing each step: an optimistic time (t_o), a most likely time (t_m), and a pessimistic time (t_p). Manually, or by use of a computer (for extremely complex programs), three time-estimates-to-completion can be made.

But even without calculating time requirements, the network depiction is useful for showing where time could be saved or where activities could be performed concurrently. For instance, in the example shown in Figure XI-5, time could be saved (or perhaps delays could be avoided) by starting event 3.2.6 (obtaining travel authorization and funds) as soon as initial contacts with key personnel had been made (3.2.3). In fact, preparation of an interview schedule or questionnaire (event 3.2.5) might start as soon as key personnel had been identified (event 3.1) as shown in Figure XI-6.

The concept of PERT is simple: its application, however, can be very complicated. Researchers who want more information about PERT should check the numerous texts on the subject, such as Robert W. Miller's *Schedule, Cost, and Profit Control with PERT*.[3] Furthermore, students at the Defense Intelligence School have access to General Electric terminals and computer programs for PERT/CPM (Program Evaluation and Review Technique/Critical Path Method) should their project planning be sufficiently complex to warrant it.

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[3]Robert W. Miller, *Schedule, Cost, and Profit Control with PERT: A Comprehensive Guide for Program Management* (New York: McGraw-Hill Book Company, Inc., 1963).

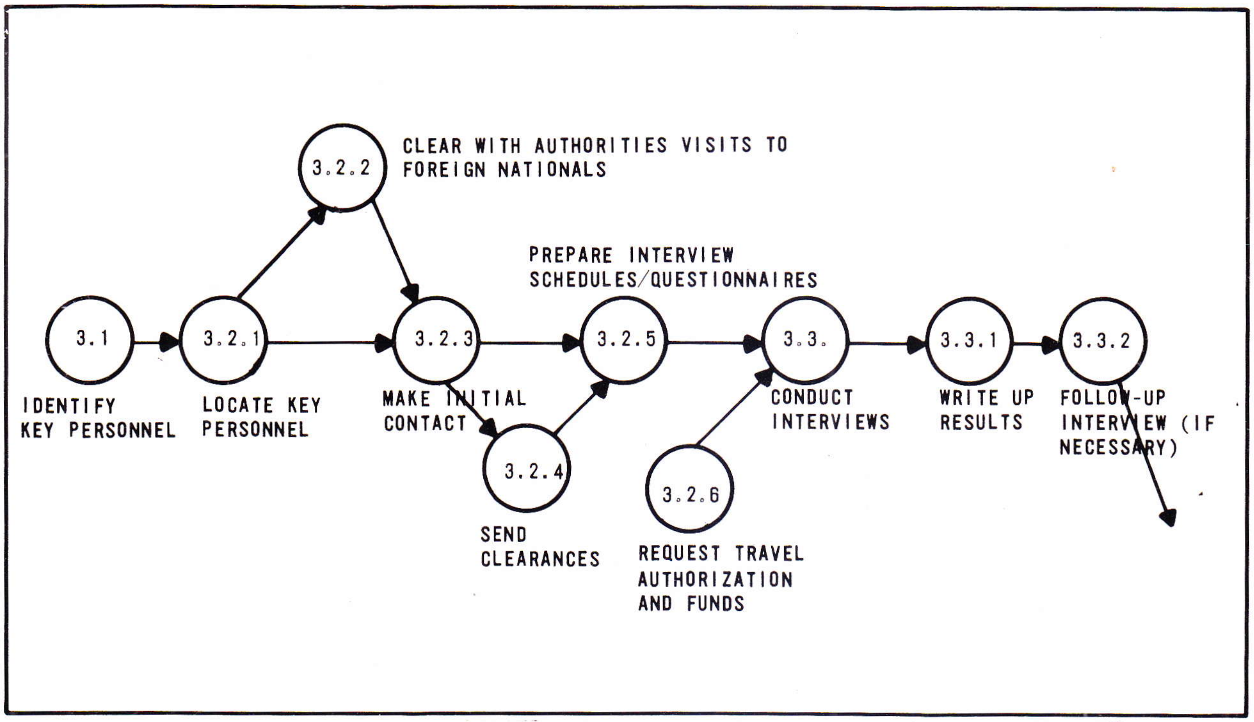

Figure XI-5. A PERT Diagram Showing all Tasks Relating to the Interview Portion of a Data Collection Phase. (Normally the "bubbles" would be numbered consecutively and would not contain captions.)

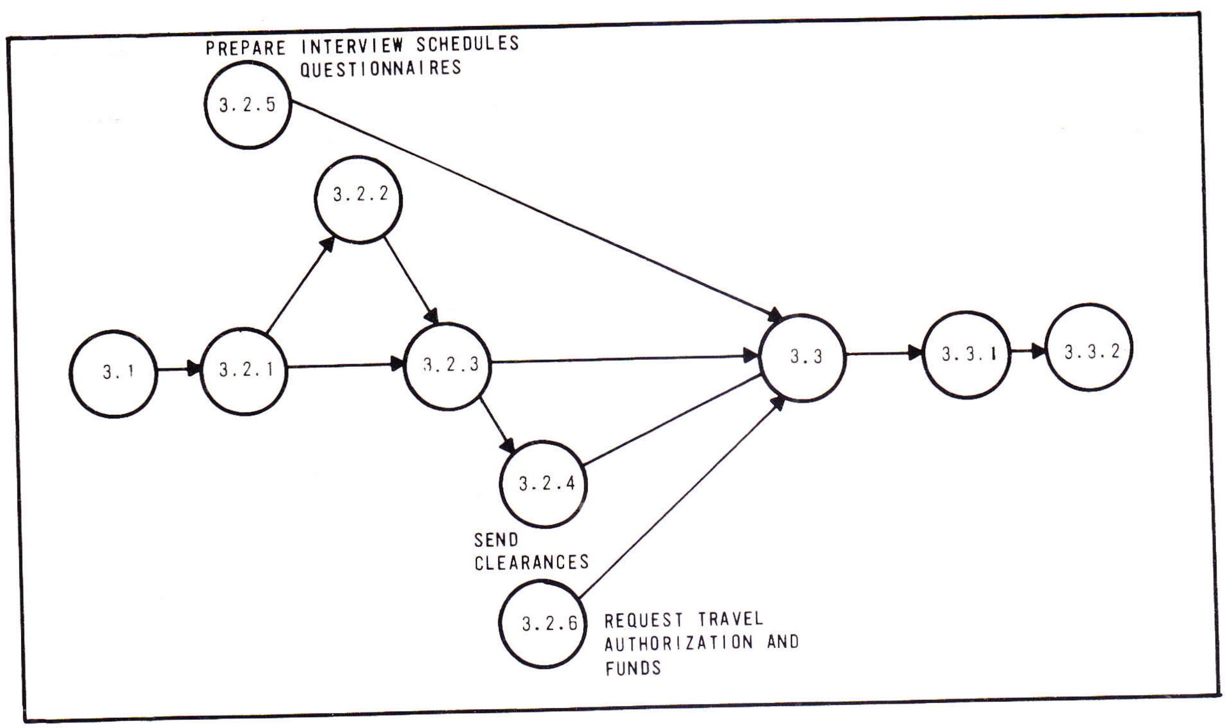

Figure XI-6. The Revised PERT Schedule of Data Collection Activities

Maintain a Journal

For the researcher with a fallible memory, a journal is a necessity. Daily journal entries help the researcher keep track of significant developments, appointments, names, telephone numbers, addresses, potential problem areas, approvals, and all of the numerous logistic and administrative details that even the simplest research program requires. Files should be maintained for all written correspondence, and logs should be kept of all research-related telephone conversations. The telephone log can be kept within the project journal if the project is a one-man effort.

In addition to helping the researcher keep track of numerous details relating to his effort, the project journal can serve as a basis for planning other research efforts, for trouble-shooting (when problems arise), and for assuring supervisors that all necessary contacts were made. The journal should be kept unclassified. Classified or sensitive information should be kept in a separate file.

A Word of Caution

Planning is a means to an end: it is not an end in itself. Perfectionists who attempt to account for every contingency never get a plan off the ground. Planning should never be more complex than the project being examined. PERT, for example, is useful when unique, one-shot projects of a complex nature are planned.[4] In order for PERT to be worth the effort, at least twenty events should be planned involving the activities of a minimum of two people, over a period of at least two months. Networks are useful in planning. But for simple, straightforward projects, a flow diagram might serve as well as the more complex PERT network.

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[4]Such as building the *first* Polaris-type submarine, the project for which PERT was developed originally.

Summary

▷ All phases of the research project should be considered during the initial project planning activity. The phases, other than the problem definition phase, include the data collection phase, the data analysis phase, and the report preparation phase.

▷ Factors to consider in planning the data collection phase include sources of data, methods to be used in obtaining the data, and logistics and coordination required to obtain the data.

▷ Factors to consider in planning the analysis phase include the methods to be used in collating the data, as well as the methodologies to be used in the analysis of the data. Mechanical considerations relating to extracting and processing data, as well as theoretical considerations relating to model selection or development must be taken into account in this planning.

▷ Factors to consider in planning the report preparation phase relate to determining the purpose for which the report will be used, the readers, approximate length of the report, as well as standards relating to style, organization, and form and formats of the report.

▷ Planning involves scheduling. The first scheduling activity for a large-scale research effort is preparing a work breakdown structure and then plotting the activities on a time line. If a research program is complex, it may also be necessary to make a network or flow diagram of activities. The complete schedule should indicate the activities to be performed, the sequence of activities, and dependencies between and among activities.

▷ One-man research programs require relatively simple schedules. But large-scale research programs require detailed schedules and plans and may necessitate the use of program planning techniques such as PERT or PERT/CPM.

▷ Maintaining a journal helps the researcher keep track of the myriad details involved in planning and conducting the day-to-day research activities.

CHAPTER XII.
COLLECTING THE DATA–PART ONE: EXPLOITING THE LIBRARY

A man will turn over half a library to make one book.

Samuel Johnson

On the night of March 20, 1935, Berthold Jacob, a German journalist living in London, was kidnapped from a restaurant in Basel, Switzerland, and taken to Gestapo headquarters in Berlin. Berthold's offense: publishing a book about the German General Staff, a book so detailed that even rifle platoons constituting the newly formed Panzer divisions were identified.

How did he get his information? Who were his sources? Where was the security "leak"? These were questions the interrogators asked Jacob. The answer, to the consternation (and grudging admiration) of the interrogators, was the "German press." Over a period of months and years, Jacob noted, recorded, and compiled press releases, obituaries, wedding announcements, and articles from German military journals. No leaks existed, no agents, and no informers were involved–only a body of "open" source material available to anyone with an "analytic mind."[1]

The intelligence researcher has access to vast amounts of open source *and* classified materials. This chapter describes how to use the type of repository in which these materials are stored, the library.

Most research projects start in a library and end in a library. Even research of an experimental nature, or research that involves polls or surveys, requires some preliminary library research. Before a manuscript is submitted for final publication, footnotes and citations must be checked in the library, and, assuming that the research product was acceptable, the library will be the final repository of the document.

Every library has unique features. Ground rules for using one library might not apply to another. But in general, libraries have the same essential elements: a system of procurement; a system of classification (which includes storage and retrieval); a system of circulation (or dissemination); and a system for providing reference assistance to the user.

The researcher should be familiar with all of these functions. For example he should be familiar with the guidelines used by the library's staff for selecting materials and the procedures for obtaining materials from other libraries; he should know how the materials are cataloged so that he can find what he needs; he should know which materials circulate and which materials have to be used in the library; and he should be familiar with the reference works and services that the reference department can provide.[2]

Library research involves three stages: an exploratory stage in which materials are identified and located; an investigative stage in which located materials are examined; and a recording stage in which information and data are extracted and recorded for later use.[3] The stages occur in this sequence, and the stages may have to be repeated in each library visited. The stages are described below. It should be noted that much of the first stage–the exploratory stage–may have been performed during the initial planning phase of the project, and that the data collection phase of the project could very likely start with the investigative stage of the holdings in a library.

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[1]Ladislas Farago, *War of Wits: The Anatomy of Espionage and Intelligence* (New York: Funk & Wagnalls Co., 1954), pp. 55-58.

[2]In small libraries, the reference department might constitute the entire staff.

[3]Henry Lester Smith and Johnnie Rutland Smith, *An Introduction to Research in Education* (Bloomington, Indiana: Educational Publications, 1959), p. 75.

The Exploratory Stage

Card catalog

The objective of the exploratory stage is to *identify* and *locate* materials relating to a specific topic. In order to optimize the search, the card catalog should be used. The card catalog is a listing of every volume contained in a library. Separate catalog cards are prepared for the author, for the title of a work, and for the subject. The library of the Defense Intelligence School, for example, has all subject cards arranged alphabetically in one file, and title cards and author cards interfiled alphabetically in another file.

All cards contain a call number in the upper left-hand corner by which a book can be identified. Different libraries may use different systems of classification. The School's library (and most U.S. Government libraries) use the Library of Congress Classification. This classification system identifies subject area groupings by letter, for example:

A – General works
D – History except American
  DK – Russia
  DS – Asiatic countries
  DT – Africa
  DU – Oceanic countries
E – General American and U.S. history
F – Canadian and Latin American history
G – Geography
H – Social Sciences
  HB-HF – Economics
  HX – Communism
J – Political Science
K – Law
Q – Science
T – Technology
U – Military science
  UB – Military Intelligence
V – Naval science
Z – Bibliography

The Dewey Decimal System, the other major classification system that may still be used by some libraries, uses numerals to identify major groups of subject matter; for example:

000 General Works
100 Philosophy
200 Religion
300 Sociology
400 Philology

500 Natural Science
600 Useful Arts
700 Fine Arts
800 Literature
900 History, Travel, and Biography

Few researchers, other than librarians, memorize the classifications. But the researcher should memorize at least those letters or numbers pertaining to his area of specialization. Library of Congress and Dewey Decimal System identifiers are identical in all libraries; therefore, a little effort spent in one library increases one's proficiency in another.

Catalog cards are used primarily for identifying works and for helping the researcher (or the librarian, if the stacks are "closed") locate a specific work. But the cards also contain much information that is valuable to the researcher. For example, the researcher might determine from the subtitle of a book that the contents probably would not be appropriate for his needs and, therefore, would not warrant much attention during his first examination of materials. Interpreting the cards can save the researcher hours of effort in obtaining works that were outdated, probably unreliable, or inappropriate.[4]

A word of caution: because a library's catalog does not contain an entry for a specific topic does not mean that no books on that topic exist. To determine what books are still in print, or books that had been published in the past, the researcher should consult the *Subject Guide for Books in Print*– the current edition as well as earlier editions. Furthermore, bibliographies in books that are available may suggest other works that might be useful.

Indexes to periodicals

The card catalog is the best source of information relating to a library's holdings of *bound* works. For unbound

[4]One of the more informative and entertaining descriptions of how the researcher might "exploit" the card catalog is given in Barzun and Graff's *The Modern Researcher,* pp. 69-75.

periodicals, however, and for information relating to current affairs, or to scientific and technological developments, the card catalog will be of little use. In these instances the researcher should use various indexes to periodicals. The two most commonly used indexes are the *Reader's Guide to Periodical Literature* and *The New York Times Index.*

Not to be overlooked are indexes of periodicals relating to various disciplines—the *Engineering Index* or the *Psychological Index,* for example, or the *Air University Index to Military Publications.* Most professional journals also publish annual indexes.

General reference works

Unless a researcher is thoroughly familiar with his topic, he will usually start his investigation by examining general reference works. The most commonly used general reference (aside from a dictionary) is the encyclopedia. Encyclopedia entries are prepared by scholars in the field, are generally updated with each new edition, and often contain a short bibliography of basic works relating to the topic. For these reasons, encyclopedias are most useful at the outset of a research project.

However, there is much variation in encyclopedias, not only among different encyclopedias, but also between different editions of the same work. For example, the eleventh edition of the *Encyclopaedia Britannica* is an exceptionally good source for historical information, and these editions are collectors' items. On the other hand, one popular encyclopedia (and its companion children's version) contains numerous errors, for example: describing the Orinoco River as emptying into the Caribbean, and depicting Lord Nelson at Trafalgar, clutching his chest with his right arm while propping himself on the deck with his left.[5]

Inexpensive but useful general references are world almanacs published by The New York Times or by the

[5]Nelson lost his right arm following the battle of Santa Cruz in 1797.

Newspaper Enterprise Association, Inc. For quick reference on basic information, even old editions are useful.

Specific reference works

Specific reference books include numerous dictionaries (e.g., technical dictionaries), various versions of Janes' compendia *(Janes' Fighting Ships, Janes' All the Worlds Aircraft,* and *Janes' Weapons Systems);* yearbooks (e.g., *The Statesman's Yearbook,* the *Europa Yearbook;* biographical dictionaries (e.g., the many versions of *Who's Who);* and atlases and gazetteers. Furthermore, every profession has its basic works, and the intelligence researcher who specializes in a given area soon learns which references are especially useful.

Classified libraries

Undoubtedly, the intelligence researcher will need to examine classified information in the course of his research. Classified holdings have unique classification systems because the classification system number is sometimes used as a document control number as well. The classified collection of the Defense Intelligence School library, for example, is arranged by document (DIL) number, and the special collection is arranged in a manner that supports the course requirements of the school. Every intelligence organization has special ground rules for determining who has access to classified information, and appropriate clearances are a necessary (but not always a sufficient) qualification for gaining access to the data.

Open stacks and browsing

Inefficient as the process may be, there is something to be said for browsing through open stacks when ground rules permit it. Sometimes titles of books or documents not directly (or seemingly not) related to the research topic act as stimuli for recalling possible solutions to problems or suggest additional information that would not be found in more conventional sources. Sometimes information is lost in the process of reducing the contents of a book to a numeral or letter for classification purposes, and without direct access to a work,

valuable information might never be discovered. Browsing is notoriously unsystematic and time consuming and perhaps is better used to polish a report than to produce the first draft.

Automated systems

Where access must be gained to large data bases whose volume increases daily, automated systems provide the only feasible method. For example, students of the Defense Intelligence School have access to two million intelligence information reports (IR's), some of which go back to 1900. Access to these documents is available through the IRISA (Intelligence Report Index Summary File) and the IRFLA (Intelligence Report File Archive) at the main DIA library at Arlington Hall. The automated systems are methods not only for locating documents, but also, in many cases, for examining their contents.

The Defense Intelligence School has four automated retrieval systems for student use: the DIAOLS/COINS system, the CIRCOL/CIRC II system, The New York Times Information Bank, and a General Electric time-sharing system.

DIAOLS (DIA On-Line System) is a time-sharing system that provides both remote and local batch-processing services on DIA files. COINS (Community On-Line Intelligence System) is an intelligence community-wide network of computer-based information retrieval systems. DIAOLS terminals provide access to the files of COINS.

CIRCOL system (Central Information Reference and Control On-Line) and the CIRC II system provide on-line support for analysis or research purposes. The data bases of these systems contain abstracts of open source documents as well as finished and unevaluated intelligence documents pertaining to scientific and technological developments in Soviet-bloc countries. System outputs are abstracts in the form of hard-copy printouts. Complete texts of documents are contained on microfiche. This system is maintained by the Foreign Technology Division at Wright Patterson Air Force Base.

The New York Times Information Bank is a system for retrieving abstracts of news and editorial matter published in *The New York Times* and in some sixty other periodicals. Abstracts of requested subject matter are projected on a CRT display, and a hard copy can be produced by a high-speed printer. Complete texts of the referenced and abstracted newspaper articles are contained on microfiche files.

The General Electric system has both time-sharing and batch-processing capabilities. The system can be used for maintaining data files, and for internal management purposes; for example: PERT/CPM, statistical analysis, and resource allocation. As such, it is more than a retrieval system.

Where to go for more information

Since even small libraries are often parts of larger libraries, and since the holdings of even small branch libraries are potentially unlimited when inter-library loan agreements exist, it is easy for the researcher to be overwhelmed by the magnitude of the resources available to him. For this reason it may be helpful for the researcher to peruse Louis Shores' *Basic Reference Sources*[6] or Contance M. Winchell's *Guide to Reference Books*[7] before he begins his data collection. Essential reading for students of the Defense Intelligence School is "Library Resources and Services in Support of the Master's Degree Program in Strategic Intelligence."[8] This document describes the organization, function, and facilities of the School library as well as the main DIA library at Arlington Hall to which the students have access.

6Louis Shores, *Basic Reference Sources* (Chicago: American Library Association, 1954.)

7Constance M. Winchell, *Guide to Reference Books* (Chicago: American Library Association, 1967).

8Defense Intelligence School, "Library Resources and Services in Support of the Master's Degree Program in Strategic Intelligence," n.d.

The Investigative Stage

The investigative stage of library research involves two operations: a preliminary examination of materials in order to determine which sources are most pertinent, complete, and authoritative; and a critical examination of selected works.

Preliminary examination

Speed is essential in the preliminary examination. The researcher rarely has time to read everything that may be available on a subject. Time is saved in the preliminary investigation by examining the "skeleton" of a text: first, the "externals"—author, co-author, date and place of publication; then the "internals"—the preface, foreword, and especially the table of contents, section headings, and index.

Inexperienced researchers typically ignore prefaces and forewords in their haste to get on with the work. This is a mistake. Often the preface—that introductory portion of a book prepared *by the author*—tells what the writer was attempting to achieve by writing the text, what was omitted, why a certain approach was taken, and states the assumptions underlying the work. Forewords—introductory material usually prepared by someone *other* than the writer—often place a work in a setting or perspective. When forewords are written by authorities in the field, the forewords *may* contain important information that is addressed in the text. But admittedly, many times forewords are nothing more than glowing tributes to an author. The ability to "skim" a text is invaluable to a researcher in this preliminary examination of materials.

Critical examination

Works that survive the first screening are subjected to a more critical examination—the examination that really constitutes the major portion of the activity known as data collection in archives. Critical examination requires that the reader constantly asks himself the same questions he would ask if he were examining an intelligence report (which, indeed, he may be doing), namely: how reliable is the source and how well does the information correspond to other information or data contained in other sources?

The Data Extraction Stage

Books and other reference materials are examined in order to find information relevant to a topic or a problem area. When needed information is located, it must be extracted for use in later analysis. In library research, data extraction is synonomous with notetaking. Notes are taken in order to record substantive information for later inclusion in the text of the report and for proper source attribution.

For notetaking, any number of possible combinations of cards, notebooks, looseleaf binders, and so on, may be used. But most researchers find it useful to keep two separate files: one file containing nothing but the bibliographic information on sources, and the other file containing subject matter content. The second file is cross referenced (by author, or by some arbitrarily assigned number) to a source. Having two separate files permits the researcher to check on, say, a publication date of a reference without having to plow through sheaves of notes on subject matter. Furthermore, some writers organize topics or information by physically arranging their notes. In this case, cards containing bibliographic information would add confusion. In order to use cards for organizing material, however, only one topic may be recorded on each separate card. This is an inviolable rule.

The manner in which notes are recorded is a personal matter. Some researchers use 3 x 5 cards; others use 5 x 6 or 5 x 8 cards. The larger sizes are better for recording long quotations, but they tend to be bulky for recording only bibliographic data. For this reason, some writers use the 3 x 5 cards for bibliographic data and the larger cards for notes. Again, some researchers use cryptic characters, shorthand, key words, and so on, whereas other researchers laboriously copy verbatim from the text, regardless of how the material will be used ultimately in the report.[9]

[9]When the author's exact words are to be quoted in the research report and when bibliographic data are extracted from the book, it is imperative that the text be copied verbatim. For other purposes, paraphrasing the text normally suffices.

Information about a source must be accurate, and it must be complete. Errors in source data reflect poorly on the researcher's competency and credibility, and they can be costly and inconvenient, especially when the researcher no longer has the original source document for reference. Experienced researchers become compulsive about recording complete bibliographic data, often because of some unfortunate experience in the past.

One time-saving procedure in extracting bibliographic data is to record the information exactly as it would appear in the bibliography of the report. Then, in final report preparation, the bibliography can be typed directly from the cards.

The medium by which notes are recorded is another personal matter. Pencil marks rub off and render cards unintelligible, but some archives do not permit pens to be used because of the danger of indelibly marking original source documents. Lightweight, portable typewirters are good for taking legible notes quickly, but even the smallest machine is bulky, cumbersome, and noisy, and often may not be used in reading rooms.

Regardless of the systems or sets of procedures used, they must satisfy the needs of the researcher. Notetaking is a serious business, and it must be done systematically and consistently. It is during the notetaking process that errors are often introduced which may be embarrassing at later stages.

Three sources for additional information on notetaking are Earle W. Dow's *Principles of a Note-System for Historical Studies,*[10] Catherine Drinker Bowen's *Adventures of a Biographer,*[11] and Barzun and Graff's *The Modern Researcher.*[12]

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[10]Earle W. Dow, *Principles of a Note-System for Historical Studies* (New York: The Century Co., 1924).

[11]Catherine Drinker Bowen, *Adventures of a Biographer* (Boston: Little, Brown and Company, 1959).

[12]Barzun and Graff, *The Modern Researcher.*

Summary

▷The library is the basic repository of information used by virtually every researcher in at least one phase of his research project.

▷Library research involves three stages: an exploratory stage in which data sources are located and identified; an investigative stage in which the sources are examined—first, cursorily, then critically; and a data extraction phase in which data are copied or paraphrased from sources for further analysis or inclusion in new text. Each stage requires certain skills.

▷In addition to catalogs and standard references found in most libraries, students of the Defence Intelligence School have access to automated retrieval systems which permit the students to draw on the data resources of various members of the intelligence community.

▷Although each library has specific ground rules, most of the techniques and procedures for locating and obtaining data are similar for all libraries. Skills in using card catalogs, standard reference works, and indexes are transferable skills and should be developed by all researchers.

CHAPTER XIII.
COLLECTING THE DATA—PART TWO: FIELD DATA COLLECTION TECHNIQUES

In the earlier years we had read too much faulty military history: the combat portions rarely rang true; they were overromanticized, inconsistent with human nature, or lacking in decisive detail. Also, in the crisis of action, the field frequently became obscured, and the historian made the sad confession: "What then happened was hidden by the fog of war." We began with the simple conviction that there must be a way to dissipate that fog.

S. L. A. Marshall

As valuable as documents and records are to the intelligence researcher, there are instances in which already recorded data may not suffice. For example, a defector may not have revealed important information simply because no one requested it; or a recent visitor to a "denied" area may have new information not yet contained in any printed document; or two accounts of an operation may differ significantly on an important detail. When it becomes necessary to dissipate "the fog of war", the researcher may have no other recourse but to collect information directly from the source. The procedures used to collect information directly from the sources will be referred to as *field data collection techniques.*

This chapter discusses those field data collection techniques commonly used by social scientists and which, with appropriate modification, can be used by intelligence researchers as well. Knowledge about field data collection techniques is important for two reasons: first, the researcher may have to employ one or a combination of the techniques in his own project; second, the

researcher must know the strengths and weaknesses of the data collection techniques in order to assess the quality of the information they yield.

Field data collection techniques that will be discussed in this chapter include the interview (and its variations); observational methods; questionnaires; mass media appeals; and the use of panels. Another technique of inquiry discussed in this chapter cuts across other techniques and may involve more than direct contact with original sources. This technique is a variation of the critical incident technique.

The Interview

Interviews are methods of eliciting information directly from a source generally in the context of a face-to-face meeting. Done well, an interview is more than a guided or unguided two-way conversation. At its best, an interview involves noting and interpreting inflections, expressions, pauses, covert glances—the whole gamut of human responses—as well as the oral responses to questions.

In intelligence jargon, professional interviewers are called interrogators. Skillful interrogators are part clinician and part subject matter specialists who have honed the interview technique to a fine art. It is highly unlikely that the intelligence researcher will require the skills of the professional interrogator. But he should be aware of the varieties of interviewing techniques that exist because the interview is one of the more commonly used methods of eliciting information from human sources in intelligence.

Interviews are used in large-scale operations, such as Operation Wringer, in the systematic interrogation of prisoners of war, as well as in small operations, for example: debriefing an attache, a traveler to a denied area, or a defector. In large-scale operations, interviews may be highly structured in the sense that specific questions formulated in advance of the interview are asked of all respondents. Highly structured interviews are appropriate when large amounts of specific information must be elicited from many respondents. Highly structured (or "directed") interviews sometimes take the form of an orally administered questionnaire.

Unstructured (or "nondirected") interviews–interviews in which the questions to be asked evolve naturally in the course of a discussion–are appropriate when general information relating to broad topic areas is to be elicited from one or several respondents. In either situation, the researcher must do his homework well in advance so that he recognizes important information when he hears it.

The type of interview most likely to be used in intelligence research is a variation of the *focused interview.* Focused interviews are interviews conducted with persons known to have been involved in specific situations. Focused interviews require the use of an interview guide or "schedule," and are directed toward specific topics about which something is already known by the researcher.[1]

A technique of interviewing that may also be useful for the intelligence researcher involves *aided recall.* In aided recall, the interviewer might show the subject a series of photographs or objects, or describe an event or situation, and then concentrate on the items that were recognized, recalled, or identified by the subject. For example, an attache who may have passed near a restricted area might be shown a series of photographs of objects or structures of the type that were believed to exist in that area and asked if he recalled seeing similar structures. Police lineups are forms of aided recall.

At times it might be desirable or necessary to interview several subjects at one time. In these instances, comments by one respondent may stimulate recall by others. When issues very sensitive to the subjects are addressed, however, the presence of others may inhibit the respondents. Furthermore, when attitudes are addressed in group interviews, it is not uncommon to find that a "group" attitude evolves that does not accurately reflect the real feelings of the individuals that constitute the group.

[1]In its clinical application, the focused interview addresses primarily the subject's attitudinal and emotional responses to a specific situation.

All data collection involves a certain amount of data recording, and interviews are no exception. Information can be recorded in writing by the interviewer or by use of tape recorders. When the words of the respondent are to be quoted, it is essential that the words are recorded verbatim, and for this reason tape recorders are especially useful. The use of a tape recorder also permits the interviewer to maintain eye contact with the subject and to concentrate on responses being made. However, in instances in which comments "not for attribution" are made, the presence of a tape recorder might inhibit a respondent.[2] In instances in which the respondent was under no obligation to reply, his permission should be obtained before recording his comments.

Protocol considerations and methods of building and maintaining rapport with the respondent are beyond the purview of this text, but they are critical, nevertheless. In situations or in cultures where courtesy is especially important, an inadvertent slight on the part of the researcher might destroy rapport before the interview even begins.

Although interviews typically involve face-to-face contact, there may be instances in which travel would be impossible, or when not enough time would be available to visit the subject personally. In these instances, telephones can sometimes be used. (Journalists do it very often when a statement is needed quickly from an agency's spokesman.) Telephone interviews do not permit the interviewer to note important physical reactions of the respondent, and they often tend to be stilted. However,

[2]One of the authors used tape recorders extensively in recording subjects' responses to questions dealing with drug use and abuse within their (Army) units. After a few moments, the subjects invariably ignored the recorders and made very candid comments. The subjects, it should be noted, had been granted immunity from prosecution, and their responses were recorded anonymously.

at times telephone interviews may be the only practical method to obtain needed information.[3]

The interview is a highly flexible and adaptable technique. It permits the researcher to adapt his questions to the peculiar requirements of the individual respondent; it permits the interviewer to assess reactions to questions and to judge the credibility of the responses. Contradictions in testimony can be clarified on the spot, and the interviewer has flexibility to pursue unanticipated leads.

The interview is not without its weaknesses, however. Every interviewer approaches a subject with an expectancy "set", i.e., the interviewer has some expectation of what the respondent might say regarding a topic. This expectancy, plus the respondent's tendency to avoid self-incrimination or embarrassment, may add up to what Pauline V. Young calls a "double dose of subjectivity."[4] Interviews are expensive in time, and compared with other forms of eliciting information, the interview may be the most expensive form of data collection relative to the amount of information obtained.

Interviews—even unstructured interviews—require planning, and mass interview efforts also require a considerable amount of interviewer training, dry runs, and rehearsals. Interviews are expensive. But at times they may be the only feasible method of obtaining needed information.

Observational Methods

Rarely do intelligence analysts and researchers have opportunities to make direct observations. But they often have opportunities for specifying how others should make and record

[3]In a sense, every telephone conversation an analyst or researcher has with his counterpart in another agency would qualify as a kind of interview.

[4]Pauline V. Young, *Scientific Social Surveys and Research,* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966), p. 223.

observations. Observational methods are most appropriate for gathering information about activities, events, objects, and characteristics and behaviors of groups.

Observational methods fall into two main classes: *uncontrolled observations* and *controlled observations*. As the name suggests, *uncontrolled observations* are observations made when and where "targets of opportunity" present themselves. Uncontrolled observations might be observations that a member of a military advisory group or an attache might make as a spectator at a war game.

One variation of the uncontrolled observation involves the observer as a participant in the activity, event, social process, or function being observed. An example of a participant observer, again, might be a member of a military advisory group who was assisting in training or in conducting operations with a foreign military force. A foreign service officer or a military attache attending a formal reception would be other examples of participant observers.

"Real time" imagery from remotely powered vehicles are, for the greater part, also uncontrolled observations. Uncontrolled observations are made when unique phenomena are to be observed—phenomena whose characteristics, and in fact, whose very existence, may be unknown.

Controlled observations, on the other hand, require the careful definition of the phenomenon to be observed, the standardization of conditions under which the observation is to be made, and, when possible, the use of electromechanical recording devices to ensure accuracy and completeness of coverage.

Perhaps one of the more common types of intelligence activities that exemplifies controlled observation would be *systematic* propaganda analysis.[5] Under ideal conditions, the "unit" of the message to be noted and counted (e.g., a reference to an event or condition, a phrase, theme, or motif) would be identified precisely before the observation was made; the

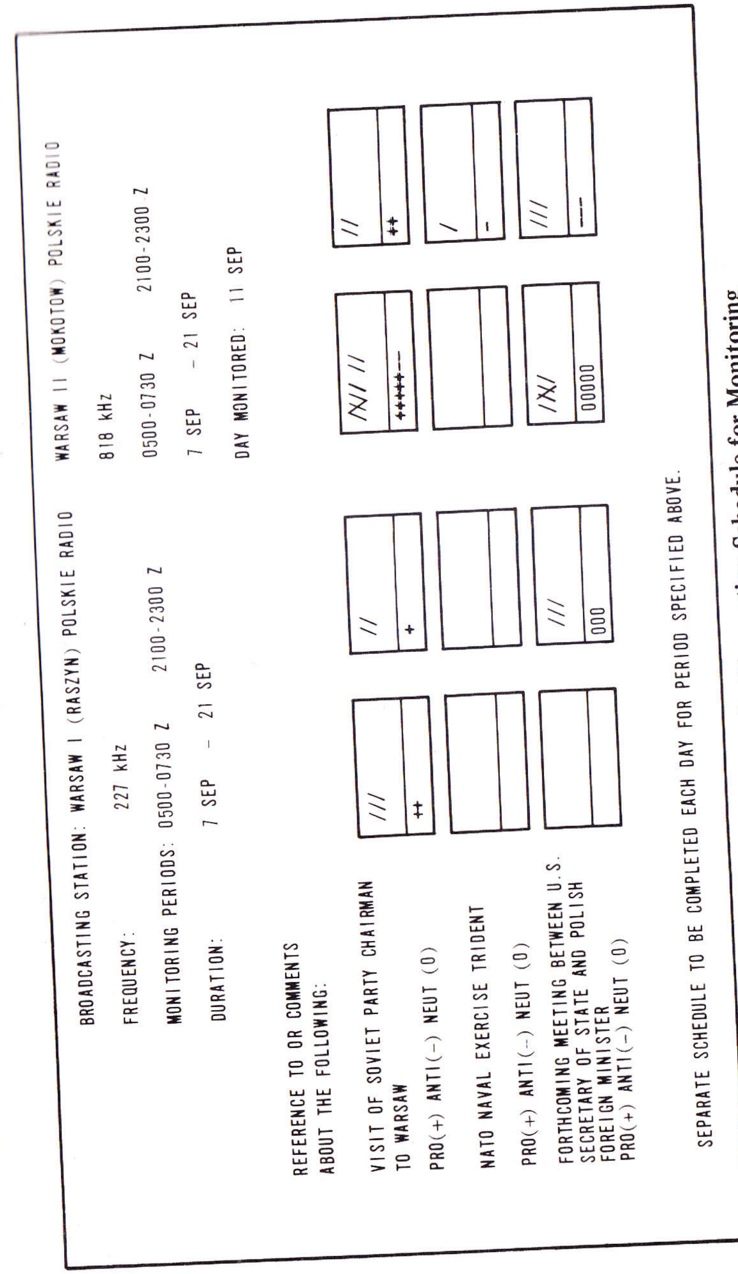
[5]Not all propaganda analysis is performed "systematically." In many instances the propaganda output is observed in an uncontrolled, *ad hoc* manner.

sources to be observed (i.e., the media) would be specified; the periods of time and frequency by which the media should be examined would be indicated; and the content observed (the "message") would be recorded or transcribed for later analysis. An example of an observation schedule for propaganda analysis is shown in Figure XIII-1.

Another type of controlled observation would be noting patterns of tactical operations, or patterns of communications, or behaviors of selected individuals *under specified conditions*. The analytical processes involved in establishing enemy doctrine often require controlled observations; for example: noting the conditions and the methods by which electronic countermeasures are employed, or noting the sequence of operations involved in their employment. These observations qualify as "controlled" because the specific types of data and the conditions under which the data were to be obtained would usually be spelled out before the data were collected.

When humans make controlled observations, the use of an "observation schedule" or checklist containing the parameters to be observed is essential. When human observers are not employed in the data collection process, some other form of recording device is required. Recordings may be in the form of imagery, telemetry data, magnetic tape recordings of electronic signals, or taped or hard copy transcriptions of domestic and foreign radio broadcasts. Controlled observations are more appropriate for use with known, recurring phenomena. For exploratory research relating to phenomena not well known, uncontrolled observations may be adequate.

Observation techniques are appropriate procedures for obtaining direct (as opposed to inferential) information about a phenomenon. When the researcher personally makes the observations, his understanding and insights invariably broaden. But the techniques are not without inherent problems. Subjectivity, for example, is present as much in the act of perception as it is in the act of interpretation. Most people "see" (literally and figuratively) what they are "programmed" to see or sometimes what they *want* to see, and measures must be taken to prevent


BROADCASTING STATION: WARSAW I (RASZYN) POLSKIE RADIO — WARSAW II (MOKOTOW) POLSKIE RADIO

FREQUENCY: 227 kHz — 818 kHz

MONITORING PERIODS: 0500-0730 Z 2100-2300 Z — 0500-0730 Z 2100-2300 Z

DURATION: 7 SEP - 21 SEP — 7 SEP - 21 SEP

DAY MONITORED: 11 SEP

REFERENCE TO OR COMMENTS ABOUT THE FOLLOWING:

VISIT OF SOVIET PARTY CHAIRMAN TO WARSAW PRO(+) ANTI(-) NEUT (0): /// ++ | // + | /X// // +++++-- | // ++

NATO NAVAL EXERCISE TRIDENT PRO(+) ANTI(-) NEUT (0): | | | / -

FORTHCOMING MEETING BETWEEN U.S. SECRETARY OF STATE AND POLISH FOREIGN MINISTER PRO(+) ANTI(-) NEUT (0): | /// 000 | /X/ 00000 | /// ---

SEPARATE SCHEDULE TO BE COMPLETED EACH DAY FOR PERIOD SPECIFIED ABOVE.

Figure XIII-1. **Sample Observation Schedule for Monitoring Content Output of Selected AM Broadcasting Stations**

biases from interfering in the activities of perceiving and recording. *Uncontrolled* observations, in addition, are notoriously expensive and risky—risky in the sense that the researcher has no guarantee that he will obtain the information he needs. *Controlled* observations reduce subjectivity and generally tend to provide information in a form most amenable to analysis. However, controlled observations require extensive planning.

Questionnaires

It is highly unlikely that "mail" questionnaires would ever be administered by the intelligence researcher to large samples of selected populations. Seldom does this activity fall within the purview of an intelligence organization; and even if it did, other organizations probably would conduct the actual survey. For example, The United States Information Agency employs private polling organizations to conduct readership surveys of its publications in foreign countries.

But the use of questionnaires with small samples of personnel related to or within the intelligence community might be an appropriate means for the researcher to obtain information from eyewitnesses to an event or participants in an operation.

In its basic form, a "mail" questionnaire consists of a number of questions ("items") that are administered to a subject or respondent. Questionnaires might be delivered and administered personally by the researcher; they might be delivered to members of a group and then collected by a designated member of that group; they might be attached to and delivered with an object such as a piece of equipment; or they might be contained within another publication. Of course, questionnaires can also be mailed directly to a respondent.

Each method of administering the questionnaire has its advantages and disadvantages. For example, by administering the questionnaire personally, the researcher is assured that all of the desired respondents were contacted, that the respondents understood the items, that the respondents understood why

their cooperation was essential, and that the questionnaire was administered properly. But administering the questionnaire personally may also be expensive in terms of travel costs and time. In addition, some respondents might hesitate to be candid when the researcher was present.

When the researcher or some other responsible individual does not personally deliver and administer the questionnaire, there is no assurance that the questionnaire will reach the desired respondents or that it will be administered properly, and this may be critical.

Returns from "mail" questionnaires are generally low. (A "good" return from voluntary subjects may be as low as 20 percent.) Consequently, if judgments are to be made on the basis of any statistical analysis of the responses, the initial sample of respondents must be fairly high.

In addition, unless the questionnaire is reasonably short and is constructed in such a manner that it requires very little effort on the part of the respondent, a written questionnaire may be perceived as an unmitigated nuisance. Unfortunately, short, highly structured questionnaires can seldom address significant issues in the depth that the researcher needs or desires. Invariably, mail questionnaires require the researcher to make tradeoffs between superficial information from many subjects and in-depth information from a very limited number of subjects.

In all probability, mail questionnaires, if they were to be used by the intelligence researcher, would probably be administered to very small and highly select samples, as mentioned earlier. Coding devices can be placed on the questionnaires to enable the researcher to identify the respondents who completed the questionnaires. Telephone calls, letters, or personal visits by the researcher could then be used to follow up the missing questionnaires. Sometimes cover letters signed by a high-ranking officer or by some other authority might motivate an uncommitted individual to respond.

Questionnaire preparation is a laborious and time-consuming operation. Items must be written ("framed"),

pretested, checked for ambiguity and clarity, modified and revised accordingly, retested, and so on. When questionnaires are to be administered to non-English speaking subjects, every item must be translated into the appropriate foreign language and then "back-translated" by some other translator to ensure that the items do in fact address the intended concept. And it is not at all unusual to encounter instances in which no foreign word equivalents exist for a concept or word in English.[6]

Although the intelligence researcher might not administer questionnaires or conduct surveys of the nature and magnitude performed by professional pollsters, he might use mail questionnaires as an indirect method for eliciting information. For example, the People's Republic of China published a pictorial magazine that contained an enclosed "mail back" questionnaire purportedly seeking the reader's opinion about the magazine's content and format. It was highly unlikely that the reader's opinion of the magazine would have any impact on the publishers, but peripheral information contained on the questionnaire might be very useful. For example, the postal markings on the returned questionnaire would indicate from where the questionnaire was mailed and presumably where the magazine was read. The number of questionnaires returned would give some indication of how widely the magazine was read (admittedly, a tenuous assumption); and the name of the respondent would be a welcome addition to any propagandist's mailing list.

Variations of the mail questionnaire might also be used to estimate the size of a radio audience. For example, one time VUNC, the Voice of the United Nations Command in the Republic of Korea, invited listeners to mail in postcards requesting music that they wanted the station to play. The

[6]For a discussion of other problems relating to collecting field data in foreign countries see Jerome K. Clauser, "Practical Considerations in Performing Field Work in the Republic of Korea," (State College, Pennsylvania: HRB-Singer, Inc., 1971).

number of cards received and the postmarks on the cards gave only a fair indication of the number of listeners but a good indication of the reception range of the broadcast station.

Mail questionnaires are relatively inexpensive compared to other methods of collecting data. Large populations can be sampled in relatively short periods of time, trained interviewers may not be required, and the questionnaires can be completed at the convenience of the respondents. If standardization is very important (e.g., asking the same question in the same manner from all respondents), the questionnaire is most appropriate.

On the other hand, as mentioned earlier, the number of returns from voluntary subjects is generally low, and even if the questionnaires were returned, there is no way of ensuring that they would be received in time to be used. Structured questionnaire items invariably call for highly structured responses—responses which might not validly reflect the respondent's true answer. Without the ability to "probe", the researcher may never obtain information of the kind and quality that he needs. Furthermore, when the questionnaires are submitted anonymously, the researcher has no way of following up the responses.

Perhaps one of the most serious drawbacks to the mail questionnaire is that the researcher has no control over the manner in which the questionnaire is administered. For example, as part of a larger study relating to drug use in the Army, highly confidential "drug use" questionnaires were to be given to all personnel in the grades E-1 to E-5 in selected units. The questionnaires were to be completed by the subjects, placed in plain envelopes (which were provided), and dropped in a "ballot box." In checking on the administration of the questionnaire in one unit, the researcher discovered that the unit's first sergeant was administering the questionnaire *orally* to each subject. Obviously, the results obtained in this manner were completely useless, and the sample size was reduced significantly when the returns from this unit were discarded.

Mass Media Appeals

One method by which information might be obtained through the use of mass media appeals was described in the previous section (VUNC's invitation to listeners to request music). But mass media can be used to solicit substantive information as well.

For example, assuming that the topic were not sensitive, advertisements for information relating to a topic or to a personage might be placed in newspapers or in scholarly journals. In 1942, for instance, the U.S. Navy and the British Admiralty made appeals through the mass media for still photographs and motion pictures of foreign travel. Specifically what was sought (but not mentioned in the appeals) were photographs of beaches. British aerial photography sufficed for vertical shots, but U.S. intelligence analysts desperately needed photographs of landing beaches taken at sea level.[7]

Mass media appeals permit no control over what, if indeed anything, is provided to the researcher. If the topic is sensitive, the researcher must be very circumspect in making known his needs. And this, in turn, may call forth a large volume of totally irrelevant data. The obvious advantage of the use of mass media is that the number of potential sources contacted is high.

Panel Techniques

A panel is a group of people selected for the purpose of making observations, judgments, and sharing personal experiences and reactions. Familiar examples of panels are juries or groups of people who evaluate consumer products. In intelligence research, a panel might consist of a number of subject matter specialists, or perhaps a group of tourists or businessmen who visited some important area. A group of pilots who made several strikes against the same target and who are likely to make more strikes against the same target would be appropriate

[7]Samuel Eliot Morison, *History of United States Naval Operations in World War II*, vol. II: *Operations in North African Waters, October 1942-June 1943* (Boston: Little, Brown and Company, 1962), p. 25.

panel members for obtaining information about air defenses or damage, for example.

Panels are especially effective for noting changes. But in order to use panels for this purpose, panel members must be queried more than once. For example, pilots would be debriefed after every successive mission flown against a specific target.

Panels are "convened" when the observations, opinions, and judgments of the members are to be elicited. All panel members need not be present *physically* at one place and time in order for a panel to be "convened." In many instances panel members might never meet their counterparts. Information could be elicited by use of a series of questionnaires sent out at appropriate times to each panel member, by telephone interviews, or by interviews conducted personnally by the researcher.

Panel techniques are effective for obtaining data for trend studies. Since information is obtained from the same subjects over time, any difference reported about the phenomenon observed is more likely to be a true difference rather than a difference arising from variance among subjects.

The likelihood of getting the amount and quality of information needed from a panel is high since the members are handpicked by the researcher. In all probability, the members' cooperation would have been obtained ahead of time, and the members would have to be briefed on the kinds of questions they would be asked. Another advantage of the panel technique is that any convenient form of eliciting information from the panel member can be used from written questionnaires to face-to-face contact. The major disadvantage of the panel technique is the potential for losing panel members through reassignment, sickness, or injury.

Variations of the Critical Incident Technique

The critical incident technique is a procedure used originally by industrial psychologists to isolate causal factors relating to a

specific event—an accident for example. In applying this technique, researchers would examine all available documentation relating to the event (*the* critical incident), would examine the physical environment in which the event occurred, and would interview all of the participants or observers of the event in question.

General S. L. A. Marshall used a variation of this technique in his operational analyses. Dismayed with the paucity of details in official records and concerned with apparent contradictions between what actually occurred and what was reported to have occurred, Marshall developed a set of procedures for collecting and validating information directly by use of primary sources—the actual participants.

Essentially the technique involved interviewing as many of the *actual participants* in an operation *as soon as possible* after the operation. The interviews were often group interviews in which the testimony of one participant was crosschecked on the spot with testimony from other participants. Marshall used observation techniques to supplement the interview data. For example, a respondent might describe how often he fired his weapon as he advanced across an open area. Marshall, on the other hand, might have noted that the respondent still had his basic load of ammunition intact.

To get a better "feel" of the operation, Marshall would "walk the terrain" as the original participants did. He might note, for example, despite the testimony of a participant who claimed that he took the enemy under fire from a certain position, that it would have been physically impossible for him to have done this. Marshall would then reexamine his subjects until all of the contradictions and inconsistencies had been resolved. Marshall would, of course, examine orders, after-action reports, and maps, and would also interview others who had played a peripheral role in the operation.

The procedures Marshall used were similar to procedures that other investigators might use, for example, General William Peers, investigating the My Lai incident. There are distinctions, however. In Marshall's approach, testimony could be reconciled

on the spot, and the cross-examination would not be incriminating. In addition, emphasis would be placed upon establishing what had happened rather than who was responsible. The technique is also similar to debriefings, but again there are distinctions. The critical incident technique, and specifically Marshall's variation of the technique, concentrates on a specific event, typically a unique, non-recurring type of event; whereas debriefings may address unique *or* recurring events. Debriefings are normally held to ascertain results. When critical incident techniques are used, the results are already known and it is the *cause* that is the focus of investigation.

Instances in which the intelligence researcher might use the critical incident technique, or variations of the technique, include post operational analyses of the type Marshall performed, or they could be used with observers or participants directly or peripherally associated with an event, for example, participants of a reconnaissance mission.

It should be noted that although the technique is classified as a data collection technique, the critical incident technique also involves analysis as well. For example, the technique involves cross-validating information, evaluating it, and placing the data in a context. These processes are essentially analytical. The technique is an eclectic one: it involves interviews, but it may also involve document analysis and firsthand observation on the part of the researcher as well.

For More Information

Useful references on field data collection techniques include the following: Mildred Parten, *Surveys, Polls, and Samples: Practical Procedures;*[8] Pauline V. Young, *Scientific Social Surveys and Research;*[9] William J. Goode and Paul K. Hatt,

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[8]Mildred Parten, *Surveys, Polls, and Samples: Practical Procedures* (New York: Cooper Square Publishers, Inc., 1965).

[9]Young, *Scientific Social Surveys.*

Methods in Social Research;[10] and A. N. Oppenheim, *Questionnaire Design and Attitude Measurement*.[11]

If the researcher had to choose among the many works available, Parten's *Surveys, Polls, and Samples* would be the best choice. The book is dated (although it has been reissued), but the basic tenets remain unchanged. Furthermore, the book not only describes techniques, but it also contains step-by-step instructions for applying the techniques to the entire range of activities related to acquiring field data.

Young's *Scientific Social Surveys and Research* and Goode and Hatt's *Methods in Social Research* are standard works in the field, and both contain theoretical discussions and practical advice on the conduct of polls and surveys. *Questionnaire Design and Attitude Measurement* by Oppenheim contains useful information on the mechanics of constructing questionnaires, interview schedules, and rating scales, as well as information on the administration of these devices.

Another useful work related to obtaining field data is *A Guide for Field Research in Support of Psychological Operations* by Alexander Askenasy and Richard H. Orth.[12] Although the guide is directed toward PSYOP activities in foreign countries, the principles of interviewing, questionnaire preparation and administration, and observation are relevant to field data collection anywhere.

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[10]William J. Goode and Paul K. Hatt, *Methods in Social Research* (New York: McGraw-Hill Book Company, Inc., 1952).

[11]A. N. Oppenheim, *Questionnaire Design and Attitude Measurement* (New York: Basic Books, Inc., 1966).

[12]Alexander Askenasy and Richard H. Orth, *A Guide for Field Research in Support of Psychological Operations* (Kensington, Maryland: American Institutes for Research, April 1970, AD 869-057L).

A masterpiece (and perhaps *the* only one of its kind) is Eugene J. Webb *et al, Unobtrusive Measures: Nonreactive Research in the Social Sciences.* The book describes innovative techniques for obtaining research data under conditions in which the presence of the researcher would interfere with the quality of the data collected, or under conditions in which it would be impossible for the researcher to collect data by interacting with the subjects. Despite the formidable title, the work is very readable and is most appropriate for the intelligence researcher, the analyst, the attache—in fact, anyone who might have to collect data unobtrusively.

Summary

▷Libraries do not always have the information or data a researcher needs. When the researcher collects information directly from the source he employs one or more *field data collection techniques.*

▷*Interviews* are common field data collection techniques. Interviews may be *highly structured* or they may be *unstructured* or "open-ended." They may be conducted individually with one subject at a time, or they may be conducted in a group setting. Interviews might be expensive and time-consuming. But they permit the researcher to follow up leads immediately.

▷It is generally cheaper to administer *questionnaires* than it is to conduct interviews. Well-constructed questionnaires elicit the same kind of information in the same manner from all respondents. Thus, it is generally easier to analyze questionnaire data than it is to analyze transcripts of interviews. But questionnaires may take a long time to develop, test, and validate. Furthermore, unless the respondent is required to reply, the response rate on questionnaires is notoriously low.

▷*Observation methods* are considered to be *controlled* or *uncontrolled.* In controlled procedures, the researcher records information about the same types of events in a regular, systematic pattern. In uncontrolled observations, the researcher records what is significant, if and when it occurs.

▷Rarely does one type of field data collection technique suffice to meet all of the researcher's requirements. More often, combinations of techniques are required; for example: following up a mail questionnaire with a telephone interview, administering questionnaires to sample populations that were observed earlier, or supplementing an examination of official records with interviews with firsthand observers or participants.

CHAPTER XIV
FOUNDATIONS OF ANALYSIS: SOME BASIC CONCEPTS

It is not enough to possess the needed relevant knowledge in some dormant state; we have to recall it when needed, revive it, mobilize it, and make it available for our problem, organize it.

George Polya

Data collected in the preceding phase are "mobilized" in the analysis phase of a research program. This phase constitutes the "moment of truth" of any research project. It is in this phase that assumptions, hypotheses, and guesses are put to the test. It is in this phase that interpretations, significance, and meaning are ascribed to the data.

This chapter discusses basic concepts that underlie *all* types of analytic processes, regardless of whether the processes are performed by an intelligence analyst or performed in the larger context of intelligence research. Topics covered in this chapter include rules for verification, causality and correlation, canons (or rules) for establishing causality, and the sometimes nebulous distinction between "quantitative" and "qualitative" approaches to analysis.

Analysis

Analysis has been defined as the process of breaking down a problem into its component parts and studying the elements separately;[1] as the mental process of "handling of data by the analyst for the purpose of incorporating the data . . . into the

[1]Smith and Smith, *An Introduction to Research in Education*, p. 185.

text of a report";[2] and as the "... minute examination of related items to determine the extent to which they confirm, supplement, or contradict each other and thereby to establish accepted facts and relationships.."[3]

There are subtle distinctions between the use of the term "analysis" in intelligence production and the use of the term in research, but essentially the term connotes breaking down larger components or elements of a problem into smaller units, performing mental (and sometimes physical) operations on collected data, and, on the basis of the operations performed, arriving at a generalization or conclusion about the larger problem that is being addressed.[4] Interestingly, the term "analysis" is derived from the Greek words *ana,* which means "up," and *lyein,* which means "to loosen": hence, "to loosen up" the data, a most appropriate description of the operation.

Induction and Deduction: A Short Review

It will be recalled from the earlier chapters that deductive reasoning is the act of drawing conclusions from previously formulated premises. It is the type of reasoning that is used, for

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[2]Defense Intelligence School, "The Analytic Process" (Washington, D.C.: The Defense Intelligence School, 1965).

[3]Armed Forces Staff College, "Intelligence for Joint Forces" (Norfolk, Virginia: Armed Forces Staff College, 1966).

[4]In the technical terminology of intelligence, analysis is usually the term that is applied to all activities and processes performed on collected data, including the formulation of hypotheses, the determination of the relevance and validity of the data, and collation and classification. In conventional research terminology, some of these activities would be performed in different phases of a research program. For example, hypotheses would be formulated during the problem definition phase, and relevance of data would be addressed during the data collection phase.

example, when mathematical proofs are established. And when used in closed systems such as mathematics, deduction is "... safe, beyond controversy, and final."[5] Deduction is sometimes referred to as *demonstrative* reasoning because it is used to demonstrate the truth and validity of a conclusion, given certain premises.

In contrast to deduction is *induction.* Induction, it will be recalled, is the process of arriving at a generalization on the basis of one or more observations. Unlike deduction which simply makes clear what is already known, induction provides new knowledge. Furthermore, induction or *plausible reasoning* invariably precedes deduction and it is the type of reasoning that analysts and researchers are required to perform more frequently.

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[5]George Polya, *Mathematics and Plausible Reasoning,* vol. II: *Patterns of Plausible Inference* (Princeton, New Jersey: Princeton University Press, 1954), p. v.

George Polya, the Stanford University mathematician, is perhaps the lending contemporary advocate of "plausible reasoning." In five separate but related works, Polya attempts to refine the science (or art) of problem solving or "heuristics," as it is formally called. Polya is quick to point out that it would be naive to believe that any given set of rules of problem solving could be applied universally to all kinds of problems. He does make an excellent case, however, for developing rules of discovery and verification in his own professional field of mathematics. For the greater part, most of the examples Polya uses to illustrate his "rules" pertain to mathematics. But it takes very little imagination to see how his "rules" would apply to other domains as well; for example, to intelligence, propaganda analysis, or law.

Some years ago HRB-Singer researchers discussed with Polya the relevancy of "heuristics" to intelligence analysis. Polya's advice was essentially that heuristics had to be developed specifically for each separate domain. The "rules" of verification that are suggested in the following pages are attempts to begin structuring an heuristic approach for intelligence analysis. The contribution of Polya is obvious.

Induction involves the processes of *discovery* and *verification*. With respect to the act of discovery, general rules or guidelines are nonexistent. For example, Polya states, "The first rule of discovery is to have brains and good luck. The second rule of discovery is to sit tight and wait until you get a bright idea"[6]—hardly comforting admonitions to the analyst or researcher facing a deadline.

With respect to verification, the second part of the inductive process, however, there are certain guidelines which the researcher may find useful. Induction can never yield "truth" with the rigor that deduction can demonstrate. Induction, on the other hand, can yield highly plausible conclusions which can be tested over time.

Since verification constitutes an important part of the analytic process, general "rules" for performing verification are discussed below. These general rules for verification apply equally to the use of qualitative or quantitative data as well as to every type of analysis in which an analyst or researcher is required to arrive at some conclusion.

Seven General Rules for Verification

The product of the process of induction is a generalization. Having arrived at a generalization (guess, conjecture, hypothesis), the researcher's problem changes from one of *discovery* to one of *verification*. Described below are seven general rules for determining the *plausibility* of a generalization. Note: the rules are methods for establishing *likelihood,* not *certainty,* that a generalization is true. The general rules are paraphrases of Polya's rules for plausible reasoning.[7]

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[6]George Polya, *How to Solve It* (Garden City, New York: Doubleday & Company, Anchor Books, 1957), p. 172.

[7]Polya, *Patterns of Plausible Inference,* p. 5.

1) *A generalization is more believable when a consequence of that generalization is verified.*

For example, an analyst might generalize on the basis of earlier observations and information that a new missile that was being developed by a foreign country was nearing an operational stage. This generalization would be strengthened should photographs of a test facility reveal burn marks on the concrete apron where a missile's propulsion system was tested. Clearly, the burn marks do not prove that a missile's propulsion system was working well, but the marks are *not inconsistent* with a successful test on the pad.

2) *The credibility of a generalization increases as the different means used to test the generalization support it.*

To return to the operational status of a missile, should a country declare the airspace near its missile test range off limits for a certain period, the initial generalization of the researcher or analyst that the missile was nearing operational status would increase. The observation of increased activity at the test range would further tend to support the initial generalization, as would increased communication traffic on the nets used for test purposes.

3) *Confidence in a generalization increases as the observable bits of evidence which support the generalization bear some proximity to each other.*

Proximity can be expressed in terms of time or geographic location. In the example above, increased activity at a test range and the declaration that the airspace over the test range was restricted bore both chronological and geographical proximity to each other.

4) *The credibility of a generalization is directly proportional to the number of instances in which the generalization was supported.*

Stated somewhat differently, every time a generalization is supported by new bits of evidence, the strength (plausibility) of that generalization increases.

5) *Confidence in a generalization increases when an imcompatible and rival conjecture is refuted.*

In the example of the missile test above, the burn marks on the concrete apron could have been caused by an accidental explosion. However, if the test facilities around the test stand showed no indication of damage, this hypothesis would be discounted and the original conjecture would be strengthened.

6) *Confidence in a generalization increases to the extent that it is consistent with another generalization that is highly credible.*

For example, if the country in which the status of the missile was in question invariably followed the same sequence of test and development phases that another country followed about which more information was available, the researcher or analyst would tend to have more confidence in predicting the next event in the missile's development cycle. This is tantamount to reasoning by analogy, and although this is a fallacious type of reasoning *in logic,* it is a very practical and common procedure in intelligence research and analysis. (This will be discussed further in Chapter XVII.)

7) *In instances in which observables support two different generalizations, the simpler generalization stands a better chance of being true.*

In the missile test example cited earlier, it would be conceivable that the missile's propulsion system had failed during the tests, but that in order to convey the impression that development was progressing according to schedule, spurious positive indications had been generated intentionally. This is certainly not an impossibility, but the simpler explanation that the test had been successful intuitively appears more plausible.

Causality and Correlation

A fundamental concern in intelligence research and analysis is the identification of causal factors.[8] Intelligence research is

[8]Nor is it surprising that this is the focus of much basic scientific research—particularly medical research.

concerned with identifying causal factors because these factors permit one to predict or to anticipate results and effects.

In certain types of intelligence analysis, causal factors can be identified readily, and the effects of these causal factors can be predicted accurately. Not surprisingly, these are the areas of scientific and technical intelligence. For example, the range of a missile is proportional to the velocity of the missile at burnout. Thus, given the velocity of a new missile at burnout, the range of that missile can be estimated.[9]

In the "softer" types of intelligence, analysts are not so fortunate. Not only cannot the effects of certain variables be predicted, but there may also be little agreement as to what constitutes the causal or contributing factors in the first place. It is because of this basic inability to establish causes rigorously that intelligence is (and probably always will be) referred to as an art or a craft rather than a science.

The case for causality is not hopeless, of course, and there are many instances in which at least a plausible if not a definitive case can be made for stating that a certain event, condition, or phenomenon brought about another phenomenon, or that a given event *will* bring about a certain type of response or reaction. Because this function is so basic to intelligence research and analysis, attention will be paid to procedures by which causal factors can be determined.

Perhaps one of the most common methods for establishing causality is to consider initially those events or conditions which are *correlated.* Correlations may be said to exist when two or more phenomena occur or vary in relation to each other. Obviously, because two phenomena occur or vary together does not imply that one phenomenon is the cause of the other. For example, there may be a positive correlation between height and weight, but obviously one trait is not the cause of the other because some people are tall and light and others may be short and heavy. But the ability to establish correlations is often a first step in establishing causes, and established correlations permit one to *generalize* from characteristics of a known

[9]Of course, the missile could also be tracked by radar and its range determined directly.

phenomenon to characteristics of an unknown (but correlated) phenomenon.

Correlations are used very often in current intelligence and in estimative/predictive intelligence analysis. "Indicators", for example, are signs or manifestations that are associated (correlated) with certain events. Certain events or conditions are called "precursors" because they had been correlated with other events which occurred later. Certain precursors are not only correlated factors, but they may also be causal factors.

When two events, conditions, or characteristics vary together and in the same "direction" (e.g., an increase in weight correlated with an increase in size), a *positive* correlation is said to exist. When two events vary inversely to each other (e.g., an increase in size with a decrease in speed), a *negative* correlation is said to exist. From the standpoint of inferring an unknown characteristic on the basis of a known and correlated characteristic, it does not matter which type of correlation exists. What is important, of course, is to understand 1) that two phenomena are directly related, and 2) to understand the manner (negatively or positively) in which they are related.[10] Perhaps this point is obvious, but the authors have encountered many researchers who expressed dismay when their tests revealed negative correlations. Yet, from the standpoint of predicting or inferring from a known to an unknown, a negative correlation may be as useful as a positive correlation.

As an aid to analysis, the establishment or identification of correlated events, activities, conditions, or other phenomena may permit other inferences to be drawn, often with a high

[10]Also important, of course, is the "strength" of the correlation, i.e., how well or to what degree two phenomena are correlated. The strength of a correlation is partly a function of the sample size. Unfortunately, in intelligence research and analysis, sample sizes tend to be very small.

degree of predictability. And, as will be discussed below, the identification of correlates is basic to the identification of causal factors.

Canons of Causality

The ability to establish causality is essential to valid prediction. As W. Stanley Jevons put it,

> A cause is defined as the necessary or invariable antecedent of an event, so that when the cause exists the effect will also exist or will soon follow. If then we know the cause of an event, we know what will certainly happen . . . .[11]

Although intuitively the researcher may feel that certain factors "caused" or brought about a certain result, it is essential that at some point in his analysis he replaces his intuition with stronger, more "public" evidence. In short, it is necessary that he subjects his speculations to certain tests. One set of tests of causality are the rules set forth by the Utilitarian philosopher, John Stuart Mill. The rules are commonly referred to as "Mill's Canons." They epitomize the scientific method (most experimental designs incorporate them in one way or another), and although they are not without their detractors (Jevons being one), they are most relevant to intelligence analysis. The " canons " are paraphrased below.

1) *If two or more instances of a phenomenon have only one characteristic or feature in common, the single characteristic or feature that exists in all instances is the cause (or effect) of the given phenomenon.*

Applied to intelligence research or analysis, this canon might be applicable in instances in which, for example, the presence of a Soviet missile expert had been noted at various test sites prior to the firing of a new missile. Diagrammed, this canon would look like this (Figure XIV-1).

[11]W. Stanley Jevons, *The Principles of Science: A Treatise on Logic and Scientific Method* (New York: Dover Publications, Inc., 1958), p. 222.

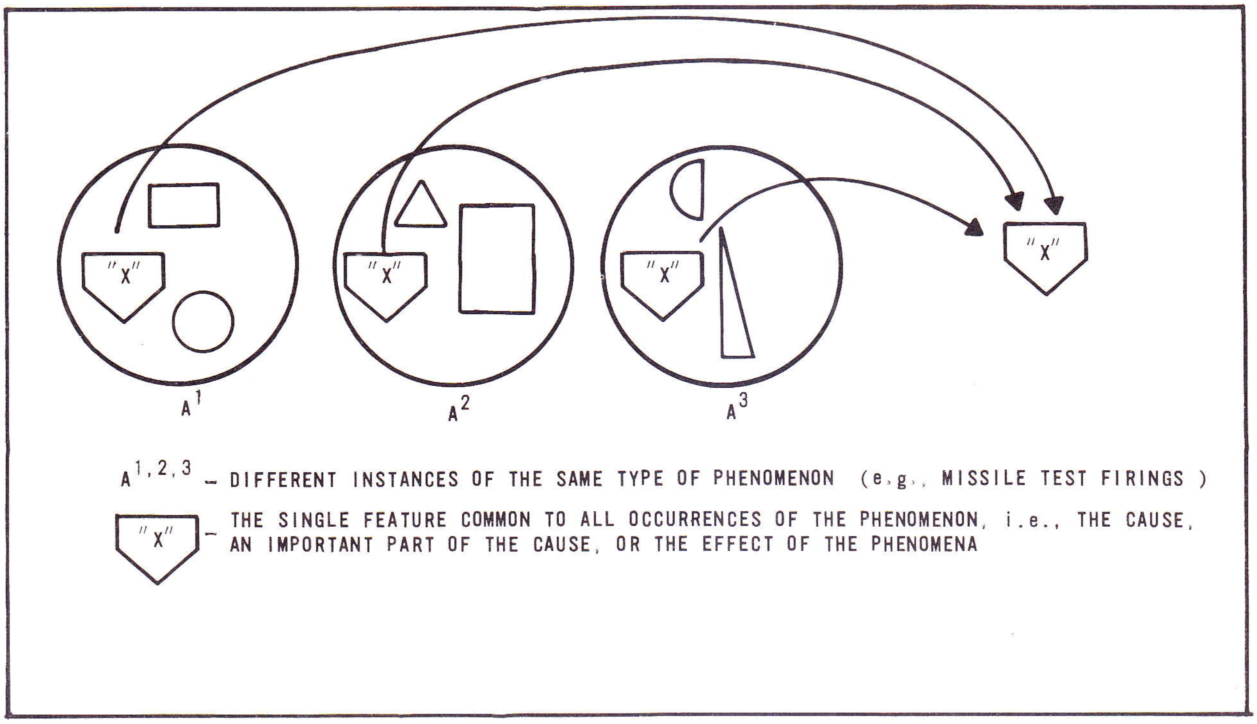

Figure XIV-1. Mill's First Canon

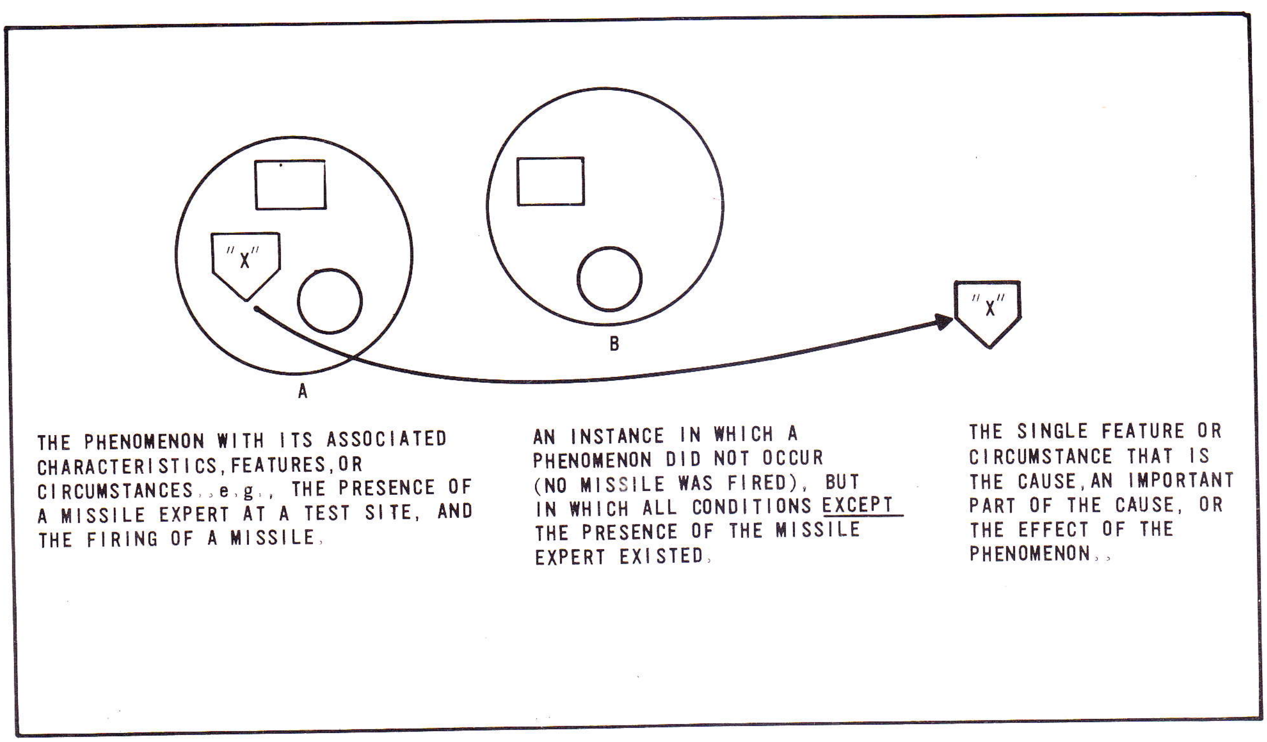

Figure XIV-2. Mill's Second Canon

2) *If an instance in which a phenomenon occurs, and an instance in which a phenomenon does not occur, have every characteristic or feature all common but one, and that one feature was present only when the phenomenon occurred, that single characteristic (feature or circumstance) is the cause, an important part of the cause, or the effect of the phenomenon.* For example, in the case of the missile expert's association with test firings, this canon would apply when all conditions existed for a test firing *except* the presence of the missile expert (and, of course, the non-occurrence of a missile firing). (Figure XIV-2.)

3) *If two or more instances in which the phenomenon occur have only one feature, condition, or circumstance in common, while other instances in which the phenomenon does not occur have nothing in common except the absence of that single condition, the condition that sets the instances apart is the cause, an important part of the cause, or the effect of the phenomenon.* For example, if two instances were encountered in which the presence of a new radar could be associated with exceptionally accurate air defenses, and several instances were encountered in which these radars were not detected, and in which the air defenses were no more accurate than usual, the cause of the increased accuracy of the air defenses could be attributable to the newly detected radars (Figure XIV-3).

4) *For any phenomenon, list all of the pertinent antecedent conditions. Then determine which parts of the phenomenon were caused by specific antecedents and subtract these parts from the overall phenomenon. The remaining parts of the phenomenon are the effects of the remaining antecedents.*

This canon is most appropriate for laboratory situations or in situations in which all pertinent antecedent conditions can be identified. But the identification of all relevant antecedent conditions may be extremely difficult in unstructured situations. As tenuous as this canon may appear, in reality it is applied quite often. For example, in scientific and technical intelligence analysis, the components and functions of a piece of captured equipment would be identified. Control devices

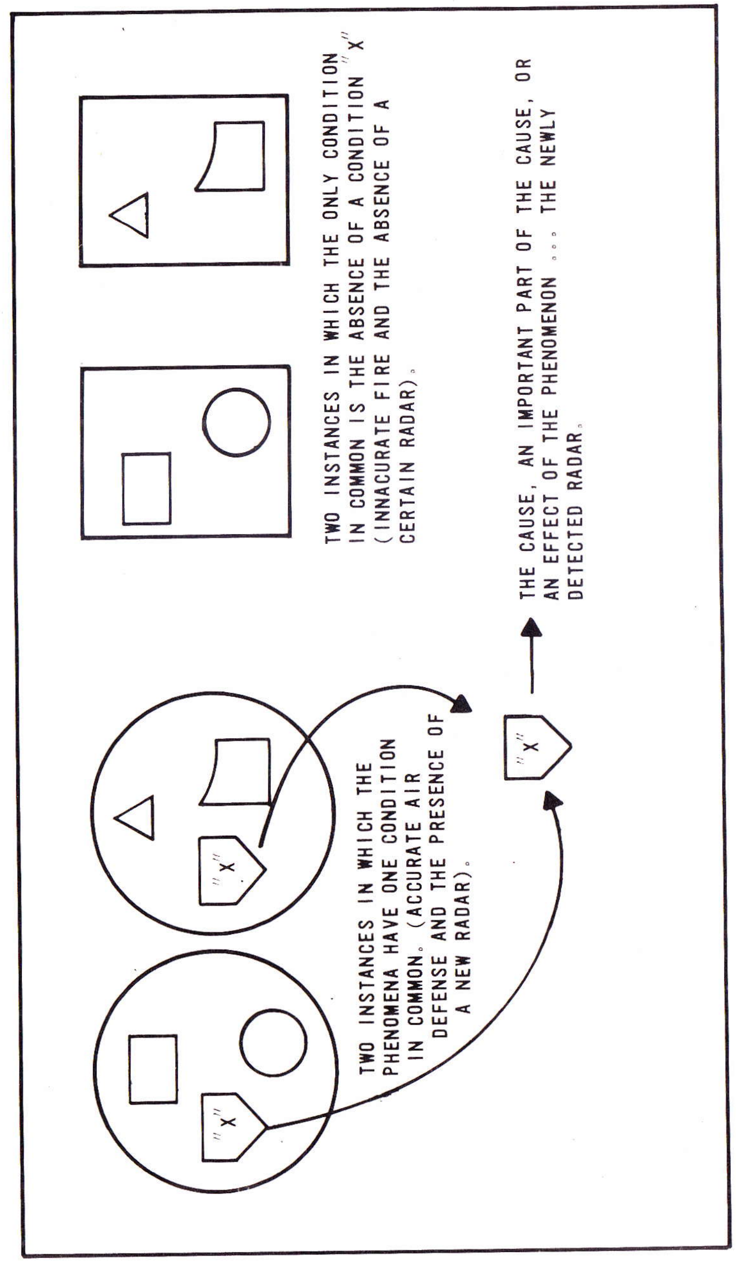

Figure XIV-3. Mill's Third Canon

would be associated with various functions. Functions for which control devices would not be identified initially would be controlled by the remaining devices not related to other functions. In layman's terms, this activity is referred to as the "process of elimination" (Figure XIV-4).

5) *When a phenomenon varies whenever another phenomenon varies, the first phenomenon is a cause of, the effect of, or is connected to the second phenomenon.* (This is a succinct statement of the relationship of correlation to causality discussed in the previous section.) For example, certain unknown telemetry signals might be associated with certain maneuvers of a missile that was being tracked by friendly radars. The extent to which the signals changed *invariantly* with maneuvers of the missile would be the extent to which those signals would be considered the cause of the missile's maneuvers (Figure XIV-5).

Obviously, causes always exist or occur *before* effects. Admittedly, the difference in time might be measurable in only nanoseconds, but "A" must precede "B" if "A" is to be identified as the cause of "B." Finally, it should be apparent that causal factors are always correlated factors, but not all correlated factors are causal factors.

"Quantitative" and "Qualitative" Analysis: A Nebulous Distinction

It is a truism to say that analysts and researchers are concerned with the rigor of their investigation. But what may not be so obvious is that one of the ways by which researchers attempt to attain rigor (or at least give the impression of rigor) may be fallacious. Specifically, naive researchers assume that the presentation of information in "quantitative" terms somehow enhances the quality of the information, or increases the reliability and validity of the conclusions. This is erroneous, of course, but the mystique of numbers persists. Casting crude observations into some statistical form will not improve the

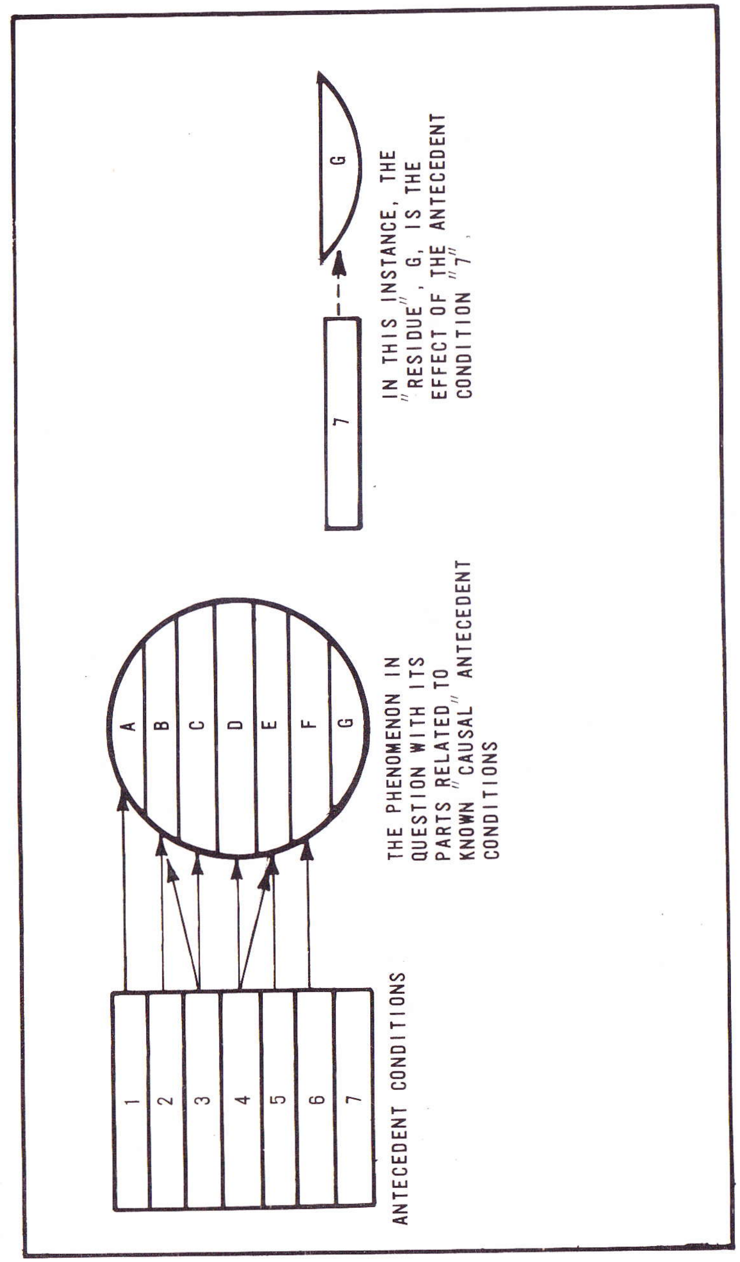

Figure XIV-4. Mill's Fourth Canon

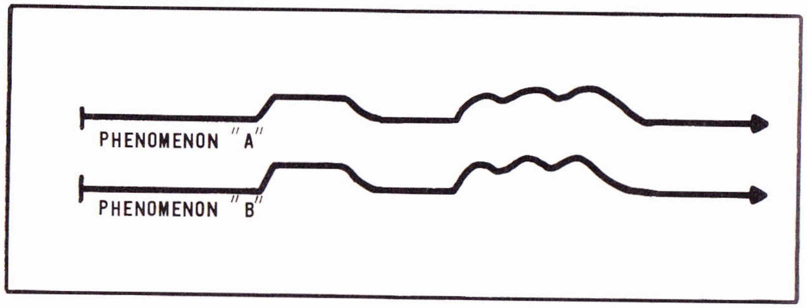

Figure XIV-5. Mill's Fifth Canon

quality of the research, nor will highly precise quantification of badly classified information yield anything more substantive than what there was initially.[12]

The phenomenon of "false precision" is not unique to intelligence research or analysis, of course. In a review of a book dealing with American intellectuals, Paul Starr, a Yale sociologist, made the following observations:

> ——— can wax enthusiastic over the most trivial statistic. Influential nonacademics, he tells us at one point, claim to read regularly "a whopping 16.5 journals." The less influential read a less whopping nine. The copy here seems to have been misplaced from an advertising agency.
>
> In the middle section of the book, devoted to the intellectuals' response to Vietnam, ——— catalogues and

[12]Classified in this context means being assigned to a category. Classification is discussed in greater detail in Chapter XV.

> totals up opinions with the thoroughness and perspicacity of a bookkeeper . . . .
>
> Examining the sources of opinion on the war, ——— comes up with the following exact statistics: 20 percent were influenced by The New York Times, 16 percent by leading intellectual journals, 10 percent by television, 31 percent by direct experiences and 13 percent by "diffuse personal encounters"—all these precise figures based on interviews conducted in 1970 on what influenced opinions 5 to 10 years earlier.
>
> This kind of false precision is a parody of social science. Science does not call for the trivializing of ideas, or for data that are little more than artifacts of the methodology.[13]

A misunderstanding of the application of statistics to any type of studious inquiry is reflected in the persisting dichotomy between qualitative and quantitative research or between nonstatistical and statistical approaches. But qualitative and quantitative approaches are merely logical extensions of the other. For example, that which is measured or quantified is always a *quality*. Quantification is a method of expressing a quality with more precision *if*—and this is critical— *if* that

[13]Paul Starr, a review of *The American Intellectual* in *The New York Times Book Review,* September 15, 1974.

quality is defined with sufficient clarity to permit reliable measurement.[14]

By the same token, there is *implied measurement* in many of the concepts which would normally be considered "qualitative." For example, to say that one government is *more* belligerent than another implies a comparison of degrees of belligerency, a crude form of measurement. A political scientist who comments upon the *high degree* of political cohesiveness within a certain country is making a quantitative statement about a quality. When analysts or researchers couch their degrees of certainty about an event's occurring in terms of ". . . it is almost certain that," or ". . . it is highly probable (or improbable) that . . . ," they are making qualitative statements which are in fact quantifiable in terms of probabilities. The Sherman Kent Chart (Figure XIV-6) is a device for converting qualities of intelligence statements into quantitative expressions of likelihood.

The distinction between approaches becomes even more tenuous when the various scales used for "measurement" are considered. The nominal scale, for example, is essentially a nonquantitative scale for assigning elements to various categories, i.e., classifying data, a topic discussed in Chapter XV;

[14] Reliability refers to the extent to which successive measurements of the same phenomenon would yield the same results.

CHANCES FOR - AGAINST	
100 – 0	CERTAINTY NO ESTIMATE
99 – 1 85 – 15	ALMOST CERTAIN. HIGHLY LIKELY.
84 – 16 55 – 45	PROBABLE. LIKELY. PROBABLY. WE BELIEVE.........
51 – 49	CHANCES JUST BETTER THAN EVEN. ON BALANCE......
50 – 50	CHANCES ARE EVEN.
49 – 51	CHANCES JUST LESS THAN EVEN.
45 – 55 16 – 84	IT IS DOUBTFUL. WE DOUBT. IMPROBABLE. UNLIKELY. PROBABLY NOT.
15 – 85 1 – 99	ALMOST CERTAINLY NOT. HIGHLY UNLIKELY. CHANCES ARE SLIGHT.
0 – 100	IMPOSSIBILITY NO ESTIMATE

Figure XIV-6. The Sherman Kent Chart, a Device for Converting Qualitative Judgments into Quantitative Terms (and Vice Versa)

and ordinal scales are "quantitative" only in the sense that the elements measured are rank-ordered in terms of magnitude.[15]

The important concern in any type of analysis is precision, but analysis cannot increase the precision of data that were collected "imprecisely," or of data that are poorly defined.

Summary

▷ The term "analysis" has slightly different connotations in intelligence research and in academic research. Despite the subtle distinctions, analysis, in both contexts, refers to breaking down a large problem into a number of smaller problems and performing mental (and sometimes physical) operations on the data in order to arrive at a conclusion or generalization.

[15]Four types of scales are used in measurement: nominal, ordinal, interval, and ratio scales. The scales are defined as follows:

1) Nominal Scale: This scale categorizes qualities. Applied to vehicles, for example, vehicles could be classified, or categorized, (*or measured*)by their type of propulsion, e.g., gasoline powered or diesel powered; or aircraft, by the nature of their wings, e.g., fixed, rotating, or swing. Nominal scales are the types of measurement scales used in classification, a basic step in the analytic process.

2) Ordinal Scale: This scale categorizes (or classifies) on the basis of qualities that can be rank-ordered; e.g., a tracked amphibious vehicle could be classified as being "more mobile" than a wheeled, non-amphibious vehicle. Foreign countries might be rank-ordered in terms of their strategic importance to U.S. national interests.

3) Interval Scale: This scale has the characteristics of the ordinal scale in addition to numerically equal distances between points on a scale. Fahrenheit and centigrade thermometers are examples of devices using interval scales. (The zero point on interval scales is arbitrary.)

4) Ratio Scale: This scale contains an absolute or true zero point in addition to equal units. Examples would be measures of weight, length, and height.

▷ Deduction and induction are two basic mental operations performed on data. Deduction is referred to as *demonstrative* reasoning because it is the process used to demonstrate the truth and validity of a conclusion. *Induction* is sometimes referred to as plausible reasoning. It is the type of reasoning one employs in discovering and verifying generalizations. It is also the process used most commonly in problem solving.

▷ Although formal rules exist for deduction, no formal rules exist for induction. Nevertheless, certain generalizations can be stated in terms of conditions which increase the plausibility of a generalization's being true. These generalizations were stated as *rules for verification* or *rules of plausible reasoning.*

▷ The ability to establish the cause of an effect is basic to predicting outcomes. Therefore, scientists and intelligence researchers are very much concerned with establishing cause and effect relationships.

▷ A correlation always exists between causes and effects, but not all correlations are causal relationships.

▷ Commonly used rules for establishing causal relationships are John Stuart Mill's "canons" which were described in this chapter.

▷ Distinctions between quantitative analysis and qualitative analysis become tenuous when it is recognized that what is quantified is always a quality, and that certain distinctions based on qualitative features often reflect a basic form of measurement or quantification.

▷ Simply because a phenomenon was expressed in quantitative terms does not necessarily imply that the research was "rigorous." Even the most rigorous mathematical or statistical analysis cannot improve the quality of poor data.

CHAPTER XV
CLASSIFICATION: A BASIC STEP IN ANALYSIS

Classification is the 'halfway house' on the road to measurement.

Alfred North Whitehead

Classification is the process of assigning information to classes.[1] The process is indispensable in research projects involving large-scale surveys where many cross-tabulations must be performed, and it is often useful in small-scale research studies, not only as a means for expediting data handling, but also as a means of problem solving as well.

Two examples cited in this chapter deal with classification in the biological and physical sciences. Significant discoveries have been made in the sciences as a result of the process of classification and, conceivably, similar "discoveries" can also be made in intelligence.

Classification in Science and Intelligence

Scientists who are able to assign an object, an organism, an event, a condition, or an activity to a class are often able to infer qualities about the phenomenon that would not be apparent otherwise.

For example, a zoologist may have noticed a track of an animal with a four-padded foot and retractable claws. With his knowledge of zoological categories, the zoologist would assign

[1]In intelligence research and analysis, data are often "classified", i.e., assigned to specific categories, on the basis of the degree of danger to national security that would result from their unauthorized disclosure. This is perhaps the most familiar sense in which the term is used in intelligence.

this animal to the class of mammals. (Amphibians have four toes, no claws; reptiles, five toes but nonretractable claws.) Having assigned the unobserved animal to the class of mammals, the zoologist could infer other characteristics about the unseen animal based on class characteristics, viz., that it is a hairy animal and that it nurses its young. The zoologist could infer that, since the animal had retractable claws, it ate meat. As a meat eater, the animal most likely had incisors, canine teeth, and probably molars. Thus, on the basis of one footprint, a zoologist could reconstruct a fairly accurate picture of the unseen animal simply by assigning the observed phenomenon to a class and then inferring other characteristics that all members of the class possessed.

The intelligence counterpart of this analog can be seen in the analysis of a foreign aircraft's capabilities. For example, the Russian Sukhoi attack aircraft, "Fencer," aside from its variable geometry, bears superficial resemblance to the Su-7BM "Fitter." Although close examination of both aircraft reveals distinguishing features, one can assume that the missions are probably comparable, and that the performance of the later "Fencer" would not be any lower than its predecessors, the Su-7 and the Su-17 aircraft.

Similarly, the Il-18 medium-range transport is a "civilian" aircraft that is almost identical to the Il-38 ASW/patrol aircraft. Since civilian aircraft are generally more easily observed than are military aircraft, a critical study of this aircraft would suggest characteristics of the less accessible military version.

To show further how classification can be used in intelligence research or analysis, the evolution of the periodic table will be discussed briefly. In 1869 Dmitri Ivanovich Mendeleev published a paper in which he classified the elements according to the properties the elements manifested. He wrote:

> When I arranged the elements according to the magnitude of their atomic weights, beginning with the smallest, it became evident there exists a kind of periodicity in their properties . . . I designated the name "periodic law" to the mutual relation between the

properties of the elements and their atomic weights. These relations are applicable to all the elements, and have the nature of a periodic function.[2]

Significant is the fact that in certain instances he found that his criterion for classification (the atomic weight) was inappropriate for ordering specific elements. For example, had Mendeleev adhered only to atomic weights, tellerium, with an atomic weight of 127.61, would have come after iodine (126.91). However, on the basis of its other properties, placing tellerium ahead of iodine on a "periodic table" put it under selenium which it resembled closely, and iodine then fell under bromine which it also resembled closely.

The value of this scheme became apparent when Mendeleev, not being able to complete his table, announced that the elements that should fit the empty spaces on his table "must be found." Furthermore, on the bases of the properties of the elements that preceded and followed those spaces, Mendeleev *predicted* what the properties would be of those elements that still had to be discovered. (Within his lifetime three of his predicted elements were discovered, and the elements had those properties predicted by Mendeleev.)

Creating an order of battle is an intelligence counterpart of constructing a periodic table. For example, based on a knowledge of enemy doctrine and from past experience, it might be established that the enemy conventionally employed two units on line while holding one unit in reserve. On the basis of the identity of one unit on line and another unit, presumably in reserve, and on the basis of the composition of both known units, the composition and possibly the identity of the other unit on line could be inferred tentatively, even though contact with this unit had not yet been made. Of course the intelligence analyst (just like Mendeleev) does not know for certain what the composition of the missing "element" will be. But he does have a plausible idea.

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[2]Harold A. Larrabee, *Reliable Knowledge* (Boston: Houghton Mifflin Co., 1945), pp. 239-248.

In another example of how classification permits analysts and researchers to make inferences, an analyst might know that the enemy conventionally deployed a certain weapon system, e.g., a SAM complex, in a particular geometric pattern. If the analyst received partial information relating to an unknown weapon system which fitted the deployment pattern of the weapon system known previously to the analyst, the configuration of this pattern would permit the analyst to assign the weapon system to a particular group of weapons. From a knowledge of the group's characteristics, the analyst could infer the configuration of the remainder of the deployment pattern as well as the probable characteristics of that system.

Systematic propaganda analysis, or *content analysis* (of foreign publications, mass media, or public announcements by key military or political figures) is another intelligence application of classification. In its most basic form, systematic content analysis involves the examination of public utterances, the identification of content elements of interest, the assignment of coded utterances (content elements) to predetermined categories, and the analysis of the results of the tabulations (e.g., correlations, interpretations, and so on). Although simply described, the implementation of the procedures may be considerably more difficult. For example, the content element (or better, the recording unit) may be a phrase, several words, or a single term.[3] Thus, recording units must be defined precisely, and so must the classes or categories to which the recording units are to be assigned also be defined unambiguously. Rules for assigning recording units to classes may require thesauri that are hundreds of pages long.[4]

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[3]Bernard Berelson, *Content Analysis in Communication Research* (Glencoe, Illinois: The Free Press, 1952), page 135.

[4]What really confounds the coding and classification process in propaganda analysis is that the statements being classified may themselves be ambiguous. For a discussion of additional problems in propaganda analysis see Jerome K. Clauser, *Propaganda Analysis: Techniques and Procedures for Analysts* (State College, Pennsylvania: HRB-Singer, 1973).

Why Classify

Analysts and researchers classify for two main reasons: to understand their data, and for convenience. As an aid to understanding, classifications often reveal relationships that are not perceptible among unorganized data. As relationships are revealed, often additional bases for comparison and prediction can be established. To go back to two examples previously cited, it was by classifying and ordering his data that Mendeleev was able to predict the properties of the missing elements. Similarly, an analyst or a researcher might infer that two different aircraft may have the same performance characteristics if both can be classified in the same category on the basis of structural similarity.

Classifying data also helps the researcher to uncover gaps in his information. And discovering the existence of these gaps is the first step in generating future collection requirements.

In addition, a classification system provides the researcher with a comprehensive overview of the structure of his data. It gives him a pattern or a *Gestalt* of the territory with which he is working.

But it is for convenience that most researchers classify their data. Having a system of classification permits one to communicate with others in generic or class names rather than having to refer to each specific entity within a class. For example, under most conditions "DD" or "destroyer" is considerably more convenient to use than "Destroyer Preston, No. 795, Later Fletcher Class." (Of course, there are other times when the complete identity must be known.)

Similarly, a classification system permits the researcher to free his mind of myriad details and to concentrate essentially on group characteristics or properities of the *class* of phenomena with which he is dealing. Since classified data are also indexed data, they can be retrieved easily. Consequently, the researcher with a classification system has a device for filtering detail when only class properties are important, as well as a device for recalling specifics when needed. In short, classifying permits the

analyst to convert infinite amounts of data into finite, manageable elements that can be stored and retrieved.

Another convenience a well-designed classification system provides is a method for accommodating new input without requiring extensive alteration of the files every time additional data are received. With an exhaustive classification system, the researcher can accommodate new data simply by expanding the categories he had already established.

Finally, in terms of convenience to the user, classification systems permit any number of people to use the same system so long as the underlying rationale of the system is understood. The rationale of the system refers to the rules by which data are assigned to certain classes (or entered into the system), and to the rules by which data can be retrieved. In fact, once these rules are spelled out explicitly, the actual classification, storage, and retrieval of data can be automated.

Coding: A Basic Type of Classification

The most basic type of classification process, and perhaps the process most familiar to analysts and researchers, is the process of coding. Admittedly, coding is done primarily when large quantities of data are processed. But coding may also be performed profitably when relatively small projects are undertaken. Coding involves two basic steps: 1) organizing the data into classes, and, 2) assigning a number or a symbol to the item according to the class in which it falls. This relatively simple process is required whenever computers are used. Every datum entered into a computer's data base is a classified and coded bit of information. But coding and classifying data helps the analyst in the manual analysis of data as well.

The summary sheets in Figures XV-1 and XV-2 contain examples of personal data and responses to specific questions that might have been made during an interrogation of PW's. Initially, information would be recorded on separate interview schedules or questionnaires. Obviously, data in this form are nearly impossible to handle. Furthermore, data on any single

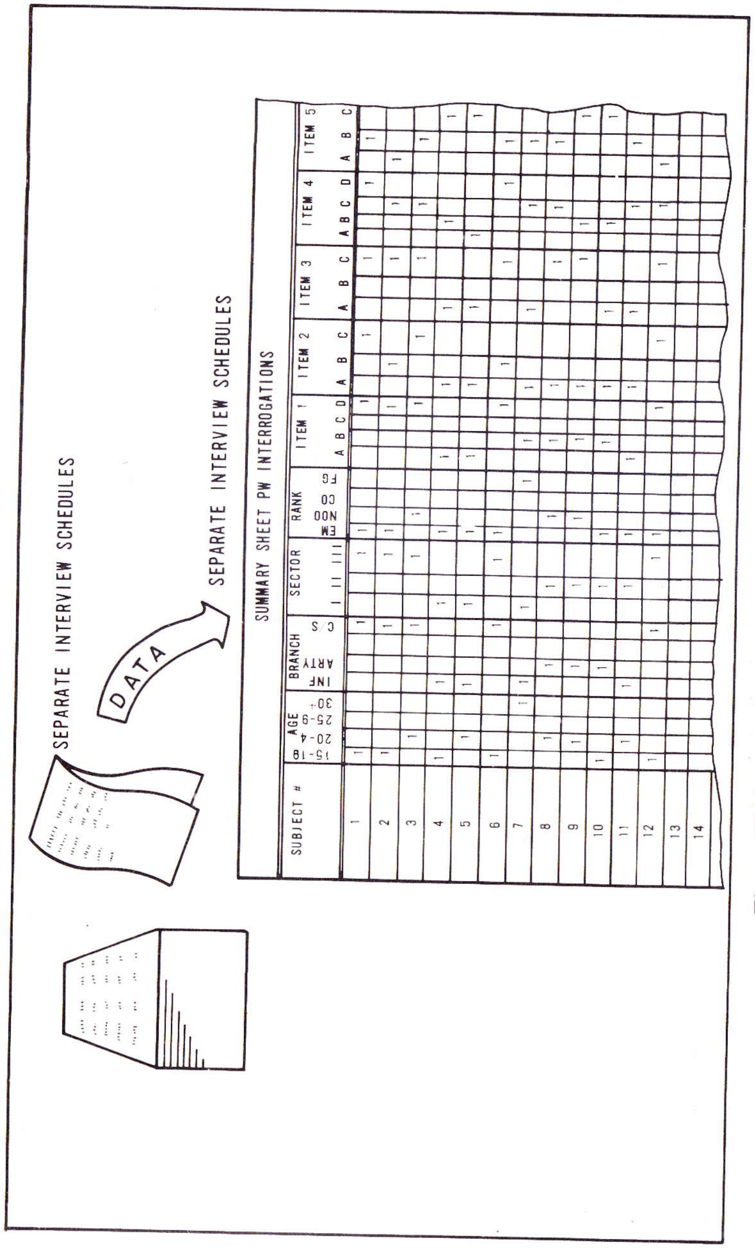

Figure XV-1. Coded Responses From All Subjects

form would reveal information from and about a single subject, but it would not reveal any pattern of responses from the *group* of PW's as a whole. However, coding the responses on the basis of pre-determined classes permits the analysis of *group* responses simply by tabulating categories of responses.

Figure XV-1 is a record of all individual responses. Figure XV-2 shows how the same data can be aggregated for additional analysis. It can be seen for example that the responses from all company grade officers were consistent, but dissimilar to responses made by the other subjects; and that the responses made by infantry and artillery personnel tended to be similar, but unlike the responses made by support personnel. Admittedly, the sample size is relatively small, and the differences might not be significant statistically, but patterns of responses do emerge from tabulations of this nature. Should these data be entered into a computer, any number of runs could be made which might reveal additional patterns of responses that are not perceptible on the aggregated response tabulation; for example; correlations between age and rank, correlations between branch and age, or correlations between sector and branch of service.

In the example just cited, the sample size (N) was only 89. If the sample size were considerably larger, data processing equipment should be used; for example: a key punch, sorter, and counter.[5] Of course, if any statistical analysis (other than counting) had to be performed on the data, a computer, or at least a hand calculator, would be needed.

The CASCON Project: Coding and Classification Applied to Strategic Analysis

A research project relating to local conflict that epitomizes the role that coding and classification play in analysis is the CASCON system (Computer-Assisted System for Handling Information on Local Conflict).

[5]The limit for convenient "hand processing" is about 150 subjects.

AGGREGATED RESPONSES OF PW INTERROGATIONS

PERSONAL DATA	RESPONSES																
	ITEM 1				ITEM 2			ITEM 3			ITEM 4				ITEM 5		
	A	B	C	D	A	B	C	A	B	C	A	B	C	D	A	B	C
AGE (N)																	
15-19 (41)	19	18		4	9	30	2	26	11	4		12	22	7	23	15	3
20-24 (44)	21	22		1	34		10	23	18	3	10	27	3	4	9	33	2
25-29 (3)		3			3			3					3			2	1
30 - (1)		1			1			1					1			1	
TOTALS (89)	40	44	0	5	47	30	12	53	29	7	10	39	29	11	32	51	6
BRANCH																	
INFANTRY (71)	30	41			39	26	6	43	27	1	9	36	23	3	28	41	2
ARTILLERY (13)	10	3			8	4	1	10	2	1	1	3	3	6	2	9	2
COM/SUPP (5)				5			5			5			3	2	2	1	2
TOTALS	40	44	0	5	47	30	12	53	29	7	10	39	29	11	32	51	6
SECTOR																	
I (67)	28	39			39	27	1	42	26	1	5	35	23	4	14	47	6
II (15)	12	3			6	3	5	9	3	1	3	3	3	6	11	4	0
III (7)		2		5	1		6	1		5	2	1	1	3	7	0	0
TOTALS	40	44	0	5	47	30	12	53	29	7	10	39	29	11	32	51	6
RANK																	
EM (78)	39	39			46	30	2	52	25	1	1	39	28	10	32	45	1
NCO (6)	1	4		1			6		4	2	5			1		5	1
CO/G (4)				4			4			4	4						4
FLD/G (1)		1			1			1					1			1	
TOTALS	40	44	0	5	47	30	12	53	29	7	10	39	29	11	32	51	6

Figure XV-2. Responses Tabulated by Category

The system permits users to retrieve information on more than two dozen cases of local conflict stored in the data bank and to compare new cases of conflict with those already stored. The system was based on a model developed by Lincoln P. Blumfield at the Center for International Studies of MIT. The model distinguishes between various phases of conflict, various factors which would tend to escalate or to diminish the intensity of the conflict, and the measures associated with the factors.

In order to analyze a new case of conflict on the basis of the cases in the data bank, the new case must be coded according to categories established for various phases. When the coding has been accomplished, data on stored cases can be retrieved for comparison. On the basis of comparisons with earlier and similar cases, specific policy measures for controlling the conflicts can be postulated.[6]

Two Meanings of "Classify"

As a verb, *classify* has two meanings: in one sense, it refers to the act of assigning a specific datum to a predetermined position in a classification scheme. In another sense, *classify* relates to the act of breaking down data and organizing them according to related subclasses. Strictly speaking, this second operation is called *division*.

To illustrate the first meaning of classify, i.e., to assign a specific datum to a predetermined slot, the activities of an intercept receiver operator who detects a radar signal can be cited. The operator might identify a signal as originating from an EW radar because the signal's parameters were all associated with a particular group of EW radars. In this case, the

[6]For additional information on CASCON, see the Minutes of the Twelfth AMG Meeting: April 28, 1970, INR Analytical Methods Group, Department of State.

predetermined upper and lower limits of each signal parameter would constitute the criteria for group assignment.[7]

To illustrate the second meaning of *classify*, i.e., breaking down data and organizing them into classes, the activities of an analyst whose concern was "military vehicles" could be cited. Here the analyst could divide the general class of "military vehicles" into any number of subclasses. For example, he might classify vehicles on the bases of modes of propulsion, number of axles, general use, weight, and so on. The discussion that follows will relate essentially to this second meaning of the term (i.e., *division*).

The Steps in Classification

The process of classification can be broken down into five steps. There are no hard and fast rules to follow, nor is there a strict sequence, although it is difficult to see how an object can be assigned to a class before the class criteria are established. The steps are as follows:

1) *The purpose or purposes the classification system is intended to serve must be determined.* This is important because the purpose the system is to serve suggests the type of system that should be used.

Students of taxonomy (the science of classification) recognize two basic types of classifications systems: natural systems and artificial systems. *Natural* classification systems are based upon the fundamental properties of the thing being classified, such as the number of parts, dimensions, color, or shape. Examples of natural systems would include the periodic table described previously, botanical classifications based on the floral parts of the plant, a classification of radars based on frequencies and other signal properties, a classification of aircraft on the mode of propulsion, number of engines, and so on.

[7]Another name for a category would be a nominal scale. Classification in the first sense of the term defined above is actually a form of measurement, albeit a crude form, as discussed in Chapter XIV.

An *artificial* classification, on the other hand, reflects primarily the user's needs. Examples of artificial systems would include a classification of radars on the basis of the country in which they were manufactured, a classification of aircraft as "bogey" or "friendly," a classification of coasts and landing beaches according to the extent to which they permit landing operations, and so on.

Halfway between the completely natural and the completely artificial classification systems are the *diagnostic* systems. Diagnostic systems reflect both natural properties of the objects or phenomena being classified, as well as the needs of the classifier. Examples of diagnostic classifications would be classifications of roads and highways on the basis of their trafficability under varying climatic conditions and classifications of radars based on the functions they perform.

Index classifications are entirely artificial systems. With index classifications, *accessibility* of data is the prime consideration. In this sense, the user's needs predominate in the selection of criteria for group assignment. Examples of index classifications would include the Dewey Decimal System, the Library of Congress classification system, the index of any book, as well as any alphabetical arrangement of data. More relevant to intelligence would be classifications of ships by pendant numbers, alphabetical listings of heads of state, and the classification of G-2 journal entries based on times of message arrivals.

To summarize: the purpose the classification scheme is intended to serve determines which type of classification system is most appropriate.

2) *When the purpose has been decided, the phenomena or data about the phenomena to be classified should be examined for those features or characteristics that could serve as possible criteria for classification.*

Here the researcher should ask himself what it is that the objects, events, or other phenomena have in common. What

features do they have that are distinctive or unique? The researcher should extend his imagination to permit consideration of all of the parameters of that which he is classifying. Some of the characteristics that come to mind may appear superficial initially. However, this step is essentially an *exploratory* one for establishing all *possibilities* for classification.

3) *From the objects, events, or phenomena to be classified, those features which would satisfy the purpose the system is intended to serve should be identified.*

The function the classification is intended to serve should point to those features of the phenomena which are relevant for classification purposes. Invariably phenomena can be classified a number of different ways. The best way to classify is that way which satisfies a particular need of the user. For example, if a researcher is considering weapon systems with large kill radii, he might find that a classification based on the weapon system's accuracy would be irrelevant since the kill radius would compensate for any lack of accuracy.

The variety of ways by which missiles can be classified according to different needs is shown below.

When range is an important consideration, missiles can be classified as long-range missiles (over 5000 nautical miles) or ICBM's, intermediate range missiles (300-1500nm) or IRBM's, or short-range missiles (under 300 nm).

When speed is an important consideration, missiles can be classified as "subsonic," "sonic," "supersonic" (air speeds ranging between Mach 1 and 5), and "hypersonic" (air speeds exceeding Mach 5).

On the basis of control, missiles can be classified as either unguided or free-flight rockets, or guided missiles. Guided missiles, in turn, can be classified according to the nature of their guidance systems, for example, command guidance, dead reckoning, position-fixing, and seeker or homing guidance systems.

There are other ways to classify missiles, but the point should be clear: phenomena invariably can be classified a number of different ways depending upon the characteristics of the thing being classified, but most importantly, depending upon the needs of the classifier.

4) *Relationships among and between classes must be identified.*

This step involves two operations. It involves, first, determining the *qualitative* criteria by which two things may be said to be related. This step then involves considering the higher and lower categories to which something can be assigned. Essentially this means that the researcher must determine (or establish) what entries would correspond to what rung on an imaginary ladder of abstraction. For instance, "Soviet Jet Fighter" is a class of airborne vehicles higher on an imaginary scale of abstraction than "MiG", but lower on the same scale than "fixed wing aircraft."

In this respect scientists are fortunate. They have specific hierarchies which remain essentially invariant, such as the hierarchy of groups of living organisms, for example:

KINGDOM
  PHYLUM
    CLASS
      ORDER
        FAMILY
          GENUS
            SPECIES

But the intelligence analyst or researcher also has a number of ready-made hierarchical structures at his disposal. For example, he has the hierarchy of military units such as divisions, brigades, battalions, and so on; he has the hierarchy of military ranks; and he has the hierarchy of governmental structures. Creating an order of battle, for example, involves associating names and locations with hierarchical structures of military organizations. These frameworks serve as convenient pegs upon which names of people, places, and activities can be hung.

The analyst and researcher will encounter instances that do not require the consideration of hierarchies. For example, radars might be classified on the bases of frequency, PRF, pulsewidth, scan rate, and mode of polarization. In this case, those radars that had the same operating parameters would be grouped together. Radars operating on frequencies between 1550 MHz and 3900 MHz, for instance, would be grouped together and identified as S-Band radars, or all of the kinds of radars associated with a given geographic area might be grouped together and then further classified according to function, e.g., GCI, EW, FC, SS, and so on. None of these classifications involves consideration of hierarchies.

5) *Classification criteria should be applied to the "population" and the entities should be assigned to specific groups.* When this step has been accomplished, a cycle has been completed. This step is identical to the first sense in which the term "classification" is used, namely, to assign an entity to a class.

Testing the Classification System

Before a classification system is implemented on any large scale, it should be pilot tested. But even before testing, the system should be examined with respect to the following questions:

1) Are the rules for assigning phenomena to categories used consistently?

2) Are the categories or classes mutually exclusive i.e., do the categories overlap? (Phenomena may be classified many ways, but each mode requires a separate system.)

3) Is the system complete for the purposes for which it was designed (i.e., are there elements to be accounted for which do not fit into existing categories)?

4) Does every classification have *at least* two divisions? (Without two subdivisions, a class cannot be said to exist.)

Classifications as Abstracts of Reality with Parts Deleted

In the preceding discussion of classification, emphasis was placed upon the "either–or" logic of a dichotomous scheme of classification. It should be remembered that *all* classifications schemes are arbitrary. Every classification system reflects the real world *more or less*. Although one can speak abstractly of an object or an event's belonging to this category or to that, the real world seldom conforms to the niceties of a classification system. Often the classifier's decision on group assignment is a toss-up. When the purpose of the system is kept in mind, little damage is done in arbitrary decisions. However, it is important to be consistent in order that the same phenomenon will always be classified the same way by all system users.

Finally, it must be remembered that even for professional taxonomists or "systematizers", the act of classification is not an end in itself. For intelligence research especially, it is only a beginning step in an analytic process.

Summary

▷ Classification, or the process of assigning information to classes, is an essential step of nearly every type of research, many kinds of problem-solving activities, and all measurement.

▷ Classification is performed for two main reasons: to gain a better knowledge of the data, and for convenience in storing and retrieving data.

▷ The classification process typically involves five steps:

- Establishing the purpose for which the classification will be performed

- Examining the data about the phenomenon being classified in order to establish bases for assigning a datum to a category

- Selecting the bases for classification in light of the purpose for which the data were being classified

- Identifying relationships among and between classes of data, e.g., hierarchies, subclasses and the like

-Assigning data to specific groups or categories

▷ Rules of classification require that

- Phenomena (or data) be assigned to categories in a consistent manner

- All classes or categories be mutually exclusive

- The system must be complete in the sense that all elements of data can be assigned to a category and that there are no elements left over

- Every superclass has at least two subclasses

CHAPTER XVI
BASIC QUANTITATIVE TECHNIQUES FOR RESEARCH AND ANALYSIS

When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely advanced to the stage of science.

Lord Kelvin

At some point in his career, practically every researcher or analyst will work with quantitative data. In some instances, the researcher personally may have to perform certain types of quantitative analyses. In more instances, the researcher will have to utilize the results of quantitative analyses performed by other researchers. This chapter reviews basic statistical and quantitative techniques that are relevant to intelligence research and analysis. In some cases only a principle is addressed, and the application of that principle is left to the reader. In other cases, particularly where a clearly identifiable technique is discussed, the application of that technique to an intelligence problem is cited.

To the researcher unfamiliar with mathematical symbology, some of the equations used in this chapter might appear arcane and formidable. However, the operations required are usually quite simple and anyone who has had some basic algebra should have no problems with the equations. The purpose of the chapter is to acquaint the researcher with basic fundamentals of statistics. It is not the intent of this chapter to train the reader to develop or apply a statistical technique to a specific problem. Entire texts are devoted to that objective.

Statistical Analysis

Statistics is the science of gathering, analyzing, and drawing inferences from masses of numerical data. There are three main types of statistics: *descriptive statistics, sampling theory,* and *inferential statistics.* Descriptive statistics indicate the magnitude and spread of a set of data. In the case of a suspected mobilization, for example, descriptive statistics could tell the researcher what the *average* number of flatcars carrying heavy equipment by train from, say, Volkovysk to Bialystok had been over the last several months. (The researcher could also compute a separate average number of flatcars returning empty.)

Sampling theory allows one to make inferences about many (or all) instances, occurrences, events, or conditions (the "population") on the basis of only a part of that population. The researcher who is concerned with the movement of materiel from the Soviet Union to Poland, for example, might know that four trains travel over a selected route daily in each direction (the entire population), but he might count the flatcars on the train only twice each week (his sample). Sampling theory permits him to plan the pattern of his observations and to decide how large his sample should be.

Inferential statistics perform several functions which concern drawing conclusions about a set or sets of data. Some inferential statistics allow a researcher to express quantitatively the *degree of confidence* he can place in his generalization of an entire population based on sampled data of that population. For example, the researcher might discover that the proportion of trains moving westward with loaded flatcars increased each successive week, and conversely, so did the number of trains moving eastward with empty flatcars also increase. Inferential statistics could indicate if the same trend would be evident whether observations were taken each day or once each week.

Statistical inference can also examine the *relationships* between two or more variables. If the number of loaded flatcars traveling west were no longer simply noted but were graphed

according to time (Figure XVI-1), then time as well as the number of flatcars would become an important variable. Using linear regression, a line could be drawn to indicate the trend toward increasing numbers of flatcars over time. Statistical inference could also be used in the same example to explore the relationships among other variables; for example, the overall lengths of the trains, and the number of passenger cars on each train.

Mathematical Analysis

Although statistical analysis is especially useful to intelligence research and analysis because conclusions must often be drawn from partial data, there are times when it is better to use simple mathematical formulas. For example, if a commander determined that he had engaged elements of two separate battalions, he could estimate the size of the forces opposing him simply by multiplying the strength of each unit times the number of units engaged. If he knew that the two battalions with which he was engaged were part of a regiment, he could also estimate the size of the overall force with which he might be engaged in the near future by multiplying the total number of units in the regiment by the strength of each unit. In this case, simple arithmetic would suffice for making an estimate.

Descriptive Statistics

Descriptive statistics are measures that are used to *summarize* large amounts of numerical information and to *create profiles* describing the information. Descriptive statistics can be expressed graphically, verbally, and mathematically. In the following section, methods and measures of descriptive statistics are introduced. They include *frequency distributions, measures of central tendency,* and *measures of dispersion.*

Frequency distributions

Specific measures of traits or characteristics are called *values.* A trait or characteristic that assumes different values is called a *variable.* For example, a researcher might be interested in the heights, ages, wealth, educational levels, or years of

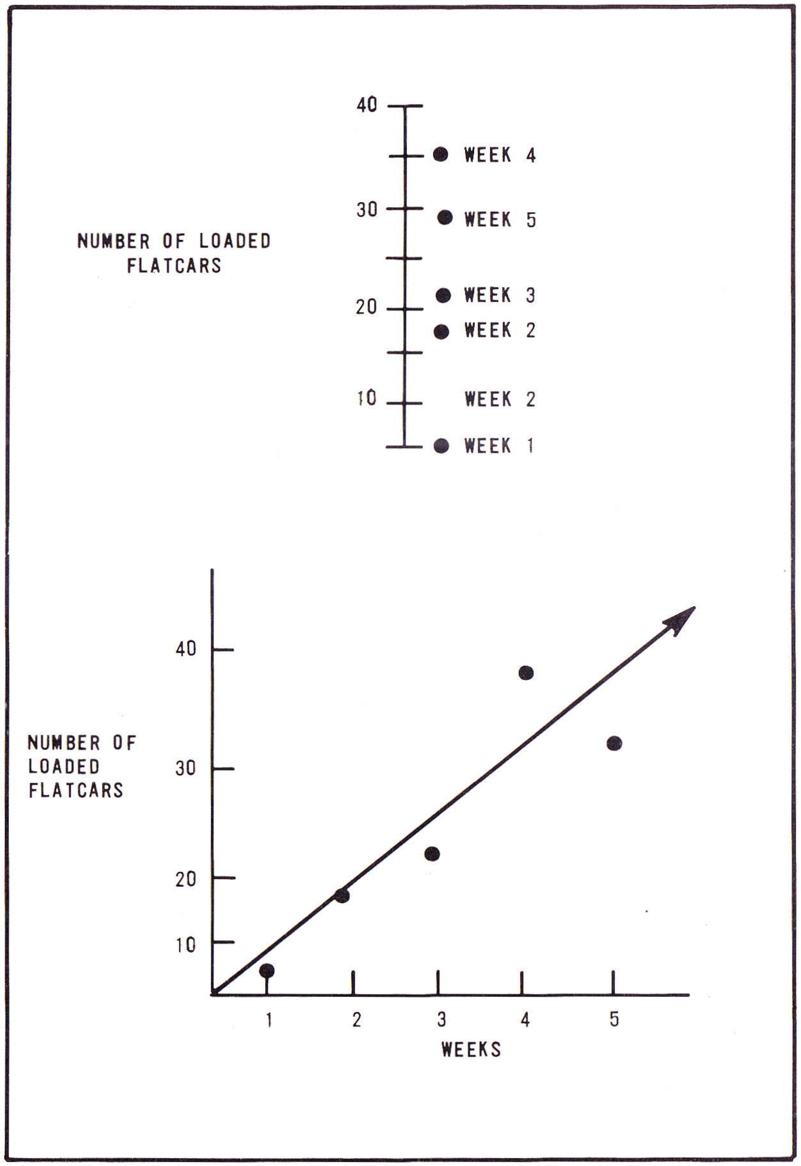

Figure XVI-1. Data Noted and Data Graphed According to Time

military service of a group of people. The values of these traits *vary* among the individuals in the group; hence, they are called *variables.*

A tally might be made of the numbers of people of each category of height, age, or any other variable. For example, the heights of 292 American soldiers could be measured, and the tally might look like this:

Height (inches)	Number of Soldiers of that Height
60 - 62	12
62 - 64	28
64 - 66	37
66 - 68	42
68 - 70	50
70 - 72	44
72 - 74	36
74 - 76	25
76 - 78	15
78 - 80	6

The heights of the soldiers are recorded according to 2-inch intervals; thus, a soldier who is 68 inches tall cannot be distinguished from a soldier who is 69 inches tall by looking at the tally sheet. It is important for the researcher to choose the correct *size* of a class interval. The size of the interval is determined by the uses to which the data will be put. In this example, a one-eighth inch class interval would be a poor choice because an individual's height often varies more than one-eighth of an inch during a single day. On the other hand, a 20-inch class interval would not show the researcher any pattern at all. It is also advisable, for most purposes, to have all class intervals the same size (e.g., all 2-inch intervals rather than some 2-inch and some 4-inch intervals).

The tally sheet indicates that many of the soldiers are 68 inches to 70 inches tall, whereas few are either very tall or very short. But the tally sheet does not give the reader a concise visual image of the pattern of heights. Graphing the data with heights recorded on an horizontal axis and the numbers of

individuals recorded on a vertical axis (Figure XVI-2), however, does produce a visual image of the data.

A graph, such as Figure XVI-2, which is a series of rectangles, is called a *histogram*. The image may be enhanced by joining the midpoints of the tops of each rectangle. The histogram shows the number of individuals constituting each class, the relative size of each class, and the distribution of the classes. The roughly symmetrical "curve" of the histogram indicates that there are about as many short soldiers as there are tall ones.

Measures of central tendency

Weapons are usually made in only one size. Weapons must be designed so that it is possible for the tallest and the shortest soldier to use them. Therefore, a weapon is usually designed to suit the "typical" or "average" soldier.[1]

The "typical" soldier's height is computed as one of three measures of central tendency: the *mean, median,* or *mode*. The *mean* is an average which may be computed by adding up all the individual values of a variable and then dividing that sum by the number of values. In the example of soldiers' heights cited earlier, there were many soldiers of the same height. Rather than adding each height individually, it is more efficient to calculate the mean in the manner shown below (Table XVI-1).

The middle height of each class interval, e.g., 61 inches as the middle of the class 60 - 62 inches, is multiplied by the number of soldiers of that height to produce the third column or the total number of "soldier-inches" in that class interval. To find the mean, columns (2) and (3) are each summed, and then the total of column (3) is divided by the total of column (2):

[1]This is no trivial matter. One reason for the popularity of the M-1 carbine in Asia was its small size and light weight.

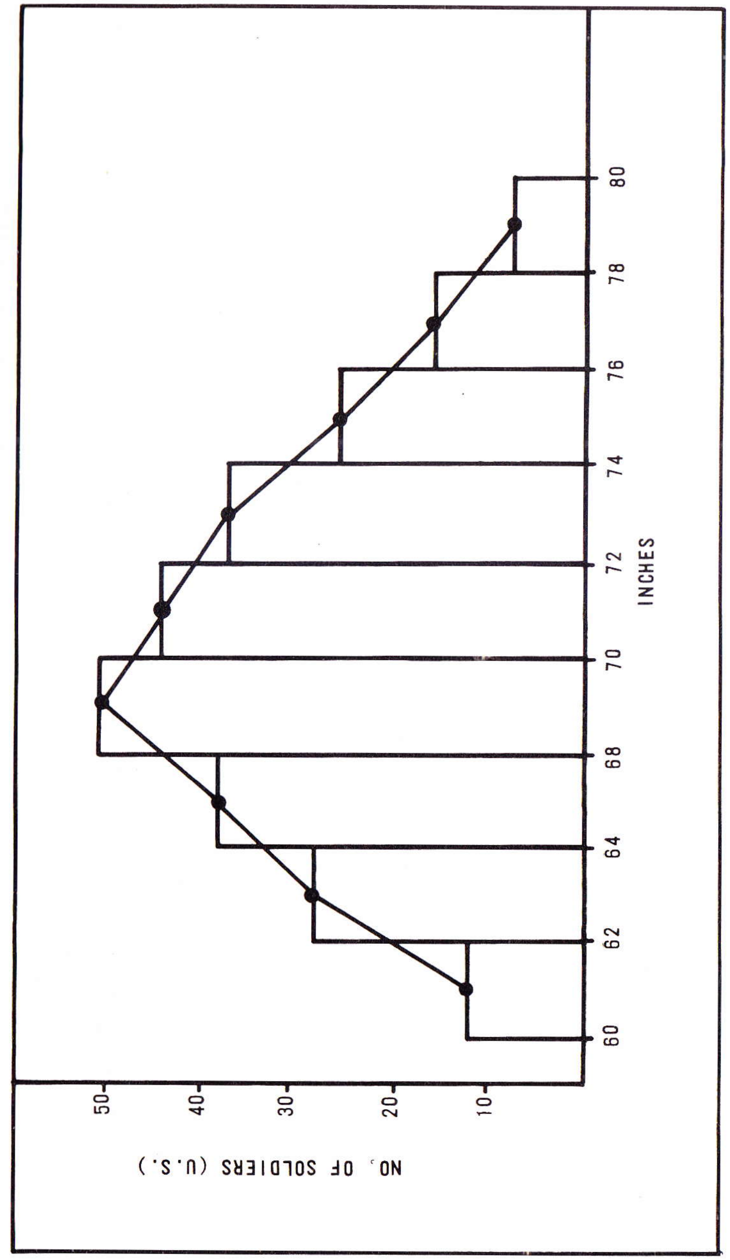

Figure XVI-2. Height: American Soldiers (Inches)

Table XVI-1. Soldiers' Heights and Total "Soldiers-Inches"

(1) HEIGHT (INCHES)	(2) NUMBER OF SOLDIERS OF THAT HEIGHT	(3) TOTAL SOLDIER-INCHES OF THAT HEIGHT
60 - 62	12	732
62 - 64	28	1764
64 - 66	37	2405
66 - 68	42	2814
68 - 70	50	3450
70 - 72	44	3124
72 - 74	36	2628
74 - 76	25	1875
76 - 78	15	1155
78 - 80	6	474
	295	20421

$$\frac{\text{Total soldier-inches}}{\text{Total soldiers}} = \frac{20421}{295} = 69.2 \text{ inches}$$

The *median* refers to the middle value of a variable. For example, if all of the soldiers were lined up in order of increasing height, the height of the soldier who was in the middle of the line would be the *median*. The median is found by arraying all the data again (Table XVI-2).

In column (3), the number of soldiers in each class is accumulated with the number of soldiers in all previous classes (e.g., 12 + 28 + 37 . . .). Since there are 295 soldiers, the soldier of *median* height would be the 148th soldier. Column (3) indicates that the 148th soldier would be somewhere between 68 and 70 inches tall.

The *mode* is the class which occurs most frequently. In the current example, the *mode* is in the class 68 - 70 inches. (Fifty soldiers fall in this class.)

If the United States were preparing to send weaponry or other military equipment to an ally, a comparative statistical analysis of the heights of American servicemen and their allied counterparts could aid planners in determining what sizes of uniforms or what types of weapons to provide.

For example, a histogram of the heights of 225 allied soldiers (Figure XVI-3) indicates that they are much shorter, in general, than their American counterparts. The mean of the distribution is 62.4 inches, whereas the *median* and *mode* both fall between 62 and 64 inches.[2] Therefore, to fit the typical allied serviceman, uniforms would have to be issued that were designed for a man 7 inches shorter than the typical American soldier.

---

[2]In normally distributed data, the *mean, median,* and *mode* are roughly equivalent.

Table XVI-2. Soldiers' Height Data Rank-Ordered

(1) HEIGHT (INCHES)	(2) NUMBER OF SOLDIERS OF THAT HEIGHT	(3) CUMULATIVE NUMBER OF SOLDIERS
60 - 62	12	12
62 - 64	28	40
64 - 66	37	77
66 - 68	42	119
68 - 70	50	169
70 - 72	44	213
72 - 74	36	249
74 - 76	25	274
76 - 78	15	289
78 - 80	6	295
	295	

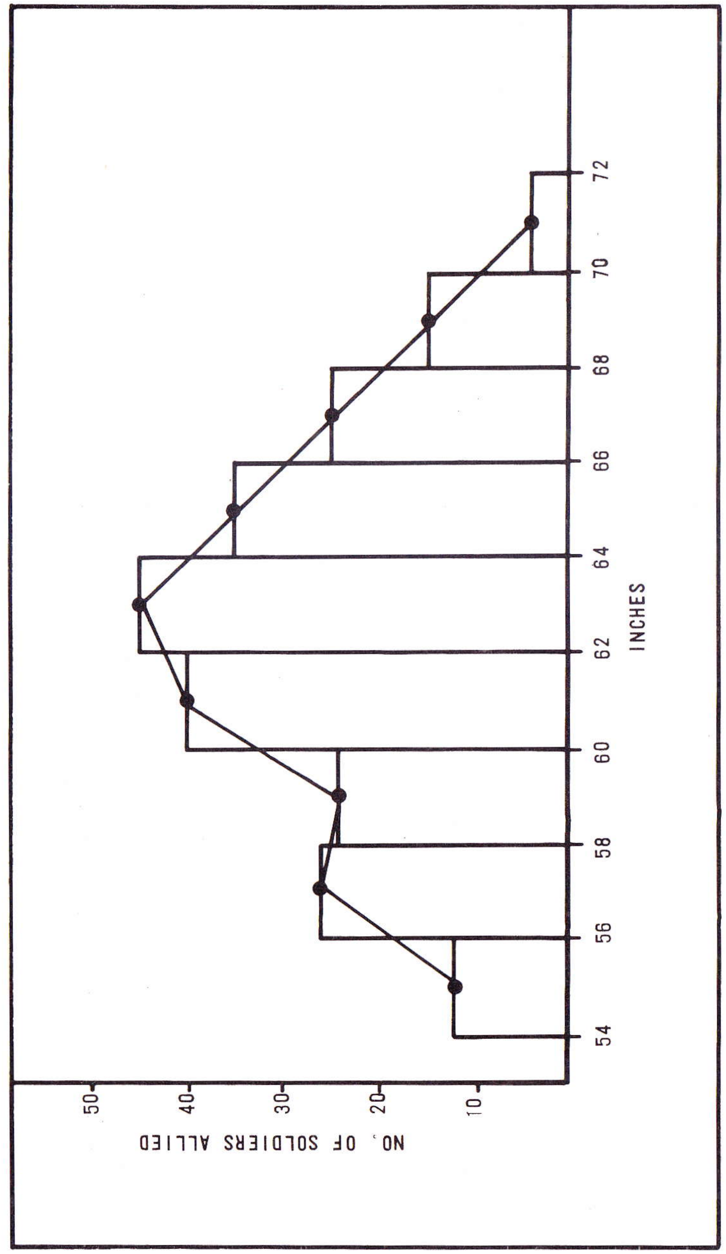

Figure XVI-3. Heights of Allied Soldiers (Inches)

Measures of dispersion

The heights of the group of American soldiers are spread over 20 inches (60 - 80 inches). If a different sized uniform were needed for the soldiers of every 2-inch class of height, then 10 different uniform sizes would be needed for the entire group. The difference in height between the tallest and the shortest allied soldier in the group (the *range* of heights) is only 18 inches. Using the same criterion as above, only 9 uniform sizes would be needed for the entire group.

Data which are spread widely about an average value are considered to be "dispersed." Histograms which are relatively tall and narrow show less dispersion than shorter, wider histograms. One of the more commonly used measures of dispersion is called the *standard deviation*. The standard deviation can express how close most of the soldiers are to the *mean* height of the group.

The formula for the standard deviation is:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}}$$

The formula involves the following steps: 1) the mean (x) must be subtracted from each individual value (x_i); 2) the results of each ($x_i - \bar{x}$) must be squared; 3) all the $(x_i - \bar{x})^2$ are summed; 4) the result is divided by the total number of items; and 5) the square root of the result is taken.

The calculation of the standard deviation for the allied soldiers' heights is shown on the following page.

(1) MIDPOINT OF HEIGHT CLASS (x_i)	(2) $(x_i - \bar{x})$ $\bar{x} = 62.4$	(3) $(x_i - \bar{x})^2$	(4) NUMBER OF SOLDIERS OF THAT HEIGHT	(5) (3) X (4)
55	-7.4	54.76	12	657.12
57	-5.4	29.16	25	729.00
59	-3.4	11.56	24	277.44
61	-1.4	1.96	40	78.40
63	.6	.36	45	16.20
65	2.6	6.76	35	236.60
67	4.6	21.16	25	529.00
69	6.6	43.56	15	653.40
71	8.6	73.96	4	295.84
			= 225	= 3473.00

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}} = \sqrt{\frac{3473.00}{225}} = 3.93$$

The midpoint of each class interval is used to represent the interval, as it was when the mean was calculated. Since there are many soldiers who are the same height, the $(x_i - \bar{x})^2$ are multiplied by the number of soldiers of a given height, and those results are summed (Column 5). This is a short cut similar to the one used in the calculation of the mean.

The standard deviation in height of the allied soldiers is 3.93 inches. This measure indicates that *most* of the soldiers are taller than 58.5 inches but shorter than 66.3 inches. If the distribution of heights formed a *normal curve* (Figure XVI-5, page 231), then 68 percent of the heights would be included within 1 standard deviation of the mean and 95 percent of the heights would fall within ±1.96 standard deviations of the mean. In this example, the distribution of heights forms a curve similar enough to a normal, bell-shaped curve so that it can be assumed that roughly two-thirds of the heights fall within 1 standard deviation of the mean.

The standard deviation of the distribution of American soldiers' heights is 4.07 inches. Therefore, most of the American soldiers are taller than 65.1 inches but shorter than 73.3 inches. In order to compare the dispersion of the two distributions, the standard deviation should be divided by the *means.* This *standardizes* the two measures of dispersion. The division is necessary because a difference of 1 inch from the mean for the shorter allied soldier is a greater *percentage* difference from the mean than is the case of the American soldier who is 1 inch taller than the mean.

The relative measure of dispersion is called the *coefficient of variation* and is equal to

$$\frac{\sigma}{\bar{x}} = \frac{3.93}{62.4} = .063$$

for the allied group, and equals

$$\frac{\sigma}{\bar{x}} = \frac{4.07}{69.2} = .059$$

for the American group.

This measure shows that the "allied" distribution is more dispersed than the "American" distribution. It should be noted that although the *range* and the *standard deviation* of the American soldiers' heights were greater, the *coefficient of variation* of the "allied" heights data was greater. The range and coefficient of variation measure different aspects of dispersion.

An Example of the Use of Descriptive Statistics

The United States and the Soviet Union constantly monitor the comparative strengths of their defense establishments. It is difficult to compare fleet strengths in the two nations' navies because the classes of ships are defined differently. As a preliminary part of the analysis of the two fleets, the number and size (displacement) of *frigates* in the two navies might be compared (Figure XVI-4). The histogram representing the ships indicates that the definition of frigates differs greatly. The Soviet frigates are much smaller than the American frigates, and there are also many more Soviet frigates.

A "typical" frigate for each navy is described by utilizing the figures below (Table XVI-3).

The mean size of the U.S. frigates is 6,379 tons, the median size is 5,670 tons, and the mode is 4,700 tons. In this distribution, which does not conform to a bell-shaped curve, values of the mean, median, and mode are quite different. The mean size of the Soviet ships is 1070 tons, and the median and mode are both 950 tons. The coefficients of variation are .2723 for the U.S. ships and .1463 for the Soviet ships. Therefore, the class of U.S. ships called frigates is a relatively broader class than Soviet frigates.

The American ships known as ocean escorts are more comparable to Soviet frigates than are American "frigates." A

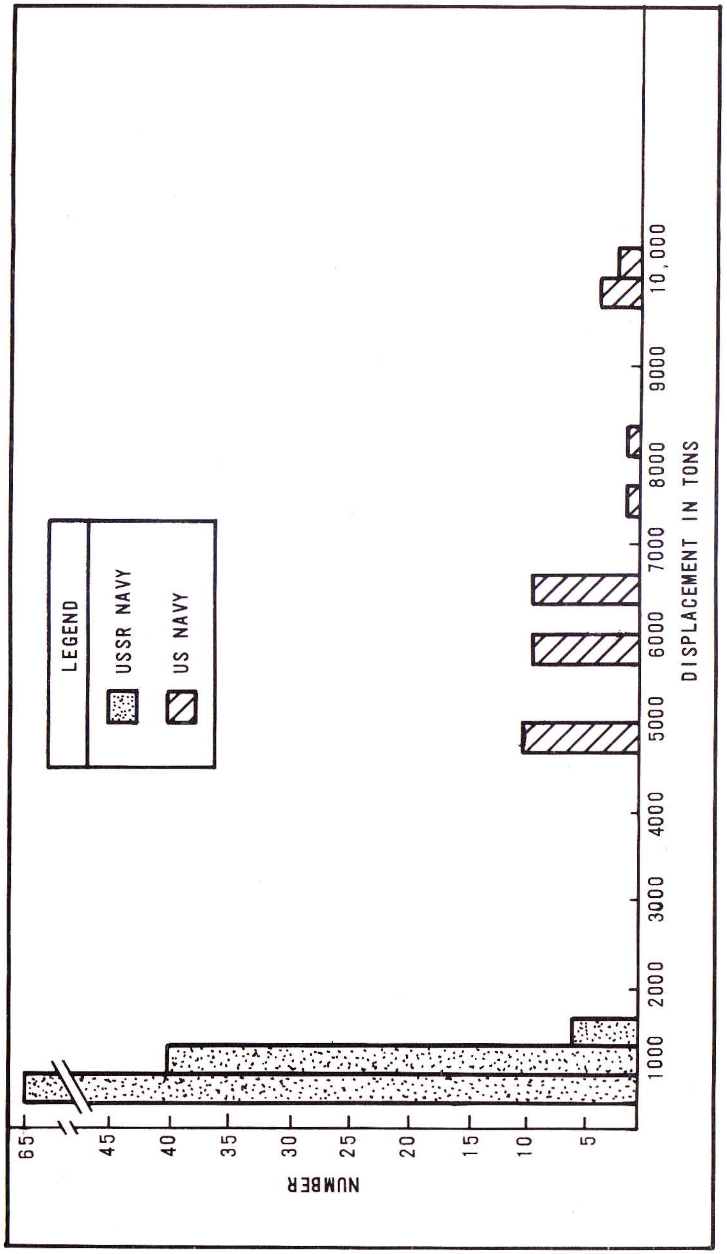

Figure XVI-4. Comparison of Frigates, U.S.S.R. Navy, U.S. Navy

Table XVI-3. Frigates of the U.S. and USSR Navies

FRIGATES OF THE UNITED STATES NAVY		
(1) DISPLACEMENT (TONS)	(2) NUMBER OF SHIPS	(3) (1) X (2)
10,150	2	20300
10,000	3	30000
8,200	1	8200
7,600	1	7600
6,570	9	59130
5,670	9	51030
4,700	10	47000
	35	223260
FRIGATES OF THE U.S.S.R. NAVY		
(1) DISPLACEMENT (TONS)	(2) NUMBER OF SHIPS	(3) (1) X (2)
1500	6	9000
1200	40	48000
950	20	19000
950	45	42750
	111	118750

histogram of ocean escorts would show that there are some ocean escorts about the same size as Soviet frigates although the U.S. class of escort ships is generally somewhat larger. The mean, median, and mode sizes of American escort ships are 3494, 4100, and 4100 tons, respectively.

Similar analyses might be undertaken for all the types of ships and various characteristics of those ships in both navies. The resultant profile of fleet strengths would then be a concise method of comparing the fleets on the basis of displacement and class.

Sampling Theory

There are many times when an analyst or a researcher would want to develop a profile of the "other side's" activities. Profiles are essential for detecting deviations from the norm. Without profiles (or other baseline data), it is impossible to determine whether a certain event or condition is typical or atypical.

For example, an intelligence analyst might want to develop a profile which described the types of information transmitted by the wire services of a specific country. He would want the profile to be representative of a "typical" day, so he would try to review wire service releases transmitted over a period of time. If the analyst could not read every story that was transmitted by the wire services, he would choose only a portion of the stories for careful review.

All of the items of interest to the researcher might include every release transmitted by the wire services during a specific month. This entire body of data is known as the *population* or *universe*. The part of the entire population which is selected for analysis is called a *sample*. If a sample is selected carefully, it is possible to make inferences about characteristics of the overall population based upon characteristics of the sample. There are several methods for selecting samples, and the method that is chosen depends upon the purpose for which the sampling is being conducted.

Random sampling

A *random sample* gives each member of the population an equal chance of being chosen. Often a random number table is utilized for selecting a random sample. Other procedures include drawing numbered slips of paper out of a hat or tossing dice.

In the current example, a random number table could be used to help choose when wire service releases would be reviewed at length. It might be predetermined that ten releases would be reviewed on a given day. The ten releases would be chosen by consulting the random number table and noting the last two digits of ten five-digit blocks of numbers. Reading across the first row, the ten two-digit numbers might be 56, 57, 42, 22, 06, 45, 55, 05, 30, and 80. For the given day, then, the releases to be reviewed would be the fifth, sixth. . . . eightieth items transmitted after 2400 hours.

An even simpler sampling scheme for this example might utilize the time/date group in the header data of each article; for example, the release transmitted each hour on or about 37 minutes after the hour might be selected. Although acceptable, this type of sampling sometimes introduces *bias*. For example, if radio broadcasts were monitored, and if the analyst examined the transmissions at 55 minutes after every hour, he might discover that sports or weather were always reported at that time. A profile based on this biased sample of radio broadcasts would suggest that sporting events and weather information were reported 100 percent of the time that the station was on the air.

A major advantage of *random sampling* is that it allows one to assess the accuracy of the measures of central tendency and measures of dispersion derived from sampling. Thus, an analyst is able to answer the question: How *confident* am I that the *mean* I calculated from sampling is within a certain range of the *mean* of the population?

The example of the heights of allied soldiers may serve to show the usefulness of establishing *confidence levels*. The 225

allied soldiers whose heights were measured were a random sample taken from a population of, perhaps, millions of soldiers. The *mean* of their heights was 62.42 inches. This mean height may be the same as the mean height of the population. On the other hand, the analyst may be challenged by someone who stated that the average allied soldier was 64 inches tall. The analyst could establish a *confidence level* for his calculation of the mean height in the following way:

He knows his sample size, sample mean, and sample standard deviation:

$$n = 225$$

$$\bar{x} = 62.42''$$

$$\sigma = 3.93''$$

From the mathematical theory associated with random sampling, he also knows that there is a chance that his sample mean may be either higher or lower than the true mean for the population. If several samples are taken from a population, most sample means will be too large or small by a small amount, but some samples will be a great deal too large or too small (Figure XVI-5).

In Figure XVI-5, if $\bar{x}_{pop.}$ is the true mean of the population, many sample means will be nearly equal to the true mean (there are 33 samples with a mean of $\bar{x}_2$, just slightly larger than the true mean). Only a few sample means will be very inaccurate (there are only 8 samples with a mean of $\bar{x}_1$, much smaller than the true mean). The distribution of errors of sample means around the true mean forms a normal or bell-shaped curve (Figure XVI-5).

The *standard error* ($\sigma_{\bar{x}}$) of the sample mean must be computed to determine how likely it is that the estimated average height of 62.42 inches falls within a certain range of the true mean height. The formula for the standard error is:

$$\sigma_{\bar{x}} = \frac{\hat{\sigma}}{n}$$

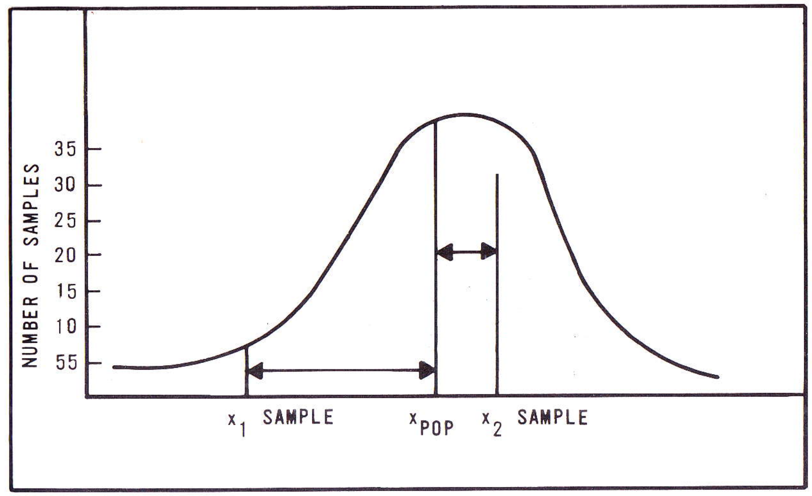

Figure XVI-5. Distance of the Sample Means From the True Mean of a Population (A Normal Curve)

If the σ of the sample is used as the estimate of the standard deviation of the population, this formula becomes:

$$\sigma_{\bar{x}} = \frac{3.93''}{225} = \frac{3.93''}{15} = .262''$$

To establish *confidence levels* for the estimated average height of 62.42 inches, a table of areas under the normal distribution must be consulted. The table tells the analyst how likely it is that his estimated mean is within a range of the true mean. For example, if the analyst specifies that the range of heights is to be

$$62.42'' - 1\ \sigma_{\bar{X}} \text{ or } 62.42'' - .262'' = 62.158''$$

to

$$62.42'' + 1\ \sigma_{\bar{X}} \text{ or } 62.42'' + .262 = 62.682'',$$

the table tells him that the likelihood that the true mean falls within this range is 68 percent.

Alternatively, an analyst can specify that he wants to find the range of heights so that there is a 95 percent likelihood that the true mean falls within an interval. The analyst would consult the table and find that the 95 percent confidence level would be 1.96 standard deviations above and below the sample mean. The boundaries of the range are then set:

$$62.42'' - 1.96\ \sigma_{\bar{X}} \text{ or } 62.42'' - .514'' = 61.906''$$
$$62.42'' + 1.96\ \sigma_{\bar{X}} \text{ or } 62.42'' + .514'' = 62.934''$$

As the confidence level *increases,* in this case from 68 percent to 95 percent, the *size of the range* also increases.

Random sampling schemes also allow the researcher to determine how many data points (value of n) must be included in the sample in order to be certain of a specific level of confidence in his results.

Stratified sampling

The object of stratified sampling is to choose a cross section of the population. Stratified sampling is accomplished in two steps. Initially, the population would be classified into subgroups which tended to share similar values for the characteristics under study, and the size of each subgroup would be recorded. A random sample would then be taken within each subgroup, with the sample size determined by that subgroup's percentage of the total population.

For example, it might be necessary to assess the opinions of villagers toward a military civic action program—the construction of a bridge perhaps. If it were not possible (nor desirable)

to interview every individual in the village, the number and type of subjects to be interviewed could be established by first classifying groups of villagers according to age, sex, and occupation (in this example), and then determining how many subjects constituted each group. The percentage of the total village population that each group constituted would be calculated. Then, for each 5 percent of the population contained in each group, one subject would be selected to be interviewed. Thus, in the example below, children constituted 30 percent of the total village population. Therefore, 6 children would be selected randomly as being representative of all of the children in the village. In this example, choosing 1 subject for each 5 percent of the total population would yield a sample size of about 20. (Controlling the sample size helps the analyst to estimate his total interviewing time.)

Table XVI-4. Stratified Sampling Scheme, Village Population

GROUPS OF INDIVIDUALS IN THE VILLAGE CLASSIFIED BY SEX, AGE, AND OCCUPATION	NUMBER OF OF PEOPLE	PERCENT OF POPULATION (%)	NUMBER IN SAMPLE
CHILDREN (UNDER AGE 15)	64	30	6
WOMEN (AGES 15 - 50)	60	28	6
MEN (AGES 15 - 50)	50	24	5
-FARMERS	(33)	(16)	(3)
-SMALL BUSINESSMEN	(11)	(5)	(1)
-OTHER	(6)	(3)	(1)
ELDERLY (50 OR OLDER)	39	18	4
TOTAL	213	100%	21

In order for at least 1 person to be interviewed from each group, at least 1 man in the category "other" would have to be interviewed. Since the category "other" represents only 3 percent of the population, the category is slightly overrepresented in the sample.

If the division of the population into subgroups (classification) is done wisely, this type of stratified sampling will yield a better cross section of the population than most random samples. However, confidence levels cannot be assessed for the values yielded from stratified samples. Also, much must be known about the population in order to define the subgroups, and in instances where demographic data are lacking, this may be a problem.

Introduction to Probability

Probability theory provides the mathematical foundation for inferential statistics. Probability theory generates "idealized" distributions of the frequency of occurrence of chance events.

The normal curve is one example of such a distribution (Figure XVI-6). In an "ideal" case, the relative frequency of specific values of x_i could be plotted accurately so that the six selected values of x_i lie on the normal curve (Figure XVI-6A). Real-world data rarely fit ideal mathematical models exactly. Events occur too frequently or not frequently enough with respect to the ideal model. For example, in Figures XVI-6B and 6C, the six selected values lie above or below the curve. However, the two sets of data represented by Figures 6B and 6C approximate the normal curve closely enough so that the curve can serve as a basis for analyzing the data.

Probabilities range from impossibility (a probability of 0) to absolute certainty (a probability of 1). With probability theory, an event must be considered as occurring or not occurring. Given that p is the probability of the occurrence of event E, the probability that E will not occur is equal to

$$q = 1 - p \tag{1}$$

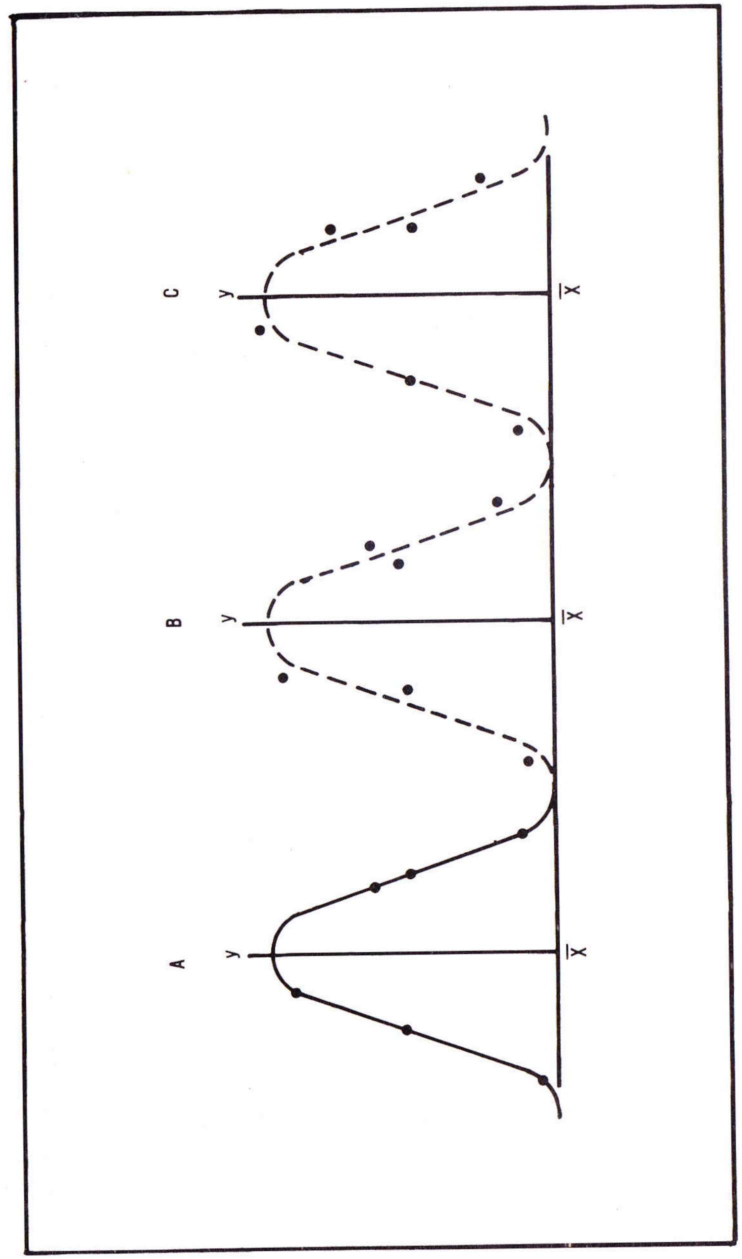

Figure XVI-6. A–The Normal Distribution. B,C–Approximations of the Normal Distribution

For example, the Democrats, Republicans, Liberals, and Conservatives each have a candidate running for the U.S. Senate. Assuming that the two former candidates each have about twice as great a change of winning the election as each of the two latter candidates, and assuming that the election is certain to be held, then

$$\Pr[D] + \Pr[R] + \Pr[L] + \Pr[C] = 1, \text{ or } \frac{2}{6}+\frac{2}{6}+\frac{1}{6}+\frac{1}{6} = 1. \quad (2)$$

The probability of the Liberal candidate's *not* winning is

$$\Pr[\text{not } L] = \frac{2}{6}+\frac{2}{6}+\frac{1}{6}=\frac{5}{6} \quad (3)$$

Equation (3) is an example of the *additive law of probability*, which states that the probability of any one of several mutually exclusive events occurring equals the *sum* of the separate probabilities of the events.

Another law of probability, the *multiplicative law,* states that the probability of all of several independent events' occurring in succession equals the *product* of the separate probabilities of the events. In the election example, the multiplicative law could be applied to the probability of two Liberal candidates' winning the Senatorial race in two states. Assuming the probability that the Liberal will win each state is $\frac{1}{6}$:

$$\Pr[L \text{ in both}] \quad \frac{1}{6} \times \frac{1}{6} = \frac{1}{36} \quad (4)$$

Probability Distributions

Data which can be counted, like the number of people in a city, are called *discrete* data. Data which can occur anywhere within a range, like the speed of a car, are called *continuous* data. Intelligence researchers must sometimes measure both discrete and continuous phenomena. There are several

important probability distributions for each type of phenomona, but only three will be discussed at length: the *normal* distribution, the *binomial* distribution, and the *exponential* distribution.

All probability distributions can be illustrated graphically by plotting the number of events on one axis and the probability of occurrence of these events on the other axis. The relationship between a *histogram* showing the frequency of certain data values and the *probability distribution* associated with the same set of data is explained below using the example of intelligence (I.Q.) test results.

A histogram showing intelligence test results (Figure XVI-7) illustrates the distribution of intelligence quotients for a given sample group. It shows that there is a large group of people with average I.Q.'s. The histogram is also *nearly* symmetrical; there are nearly equal numbers of people with high I.Q.'s and with low I.Q.'s.

Normal distribution

The appearance of the histogram tells the experienced researcher that the distribution can be approximated by a *normal distribution.* When the normal distribution is used as the model for the data, further analysis is based upon the normal distribution rather than upon the original histogram of data. The fitting of real-world data to ideal probability distributions is often associated with taking a sample from a large population. For example, the normal distribution (Figure XVI-7) is used to describe intelligence test results from a *sample* of 230 people out of a population of 10,000 people. The researcher is assuming that the distribution of I.Q.'s in the entire *population* is normal. The slightly irregular distribution of I.Q.'s in the sample arises only because the sample is not quite representative of the population.

The normal distribution is a *continuous distribution.* It describes many types of data well, including abilities, heights of people, and the slight irregularities in the sizes of a product produced by machine.

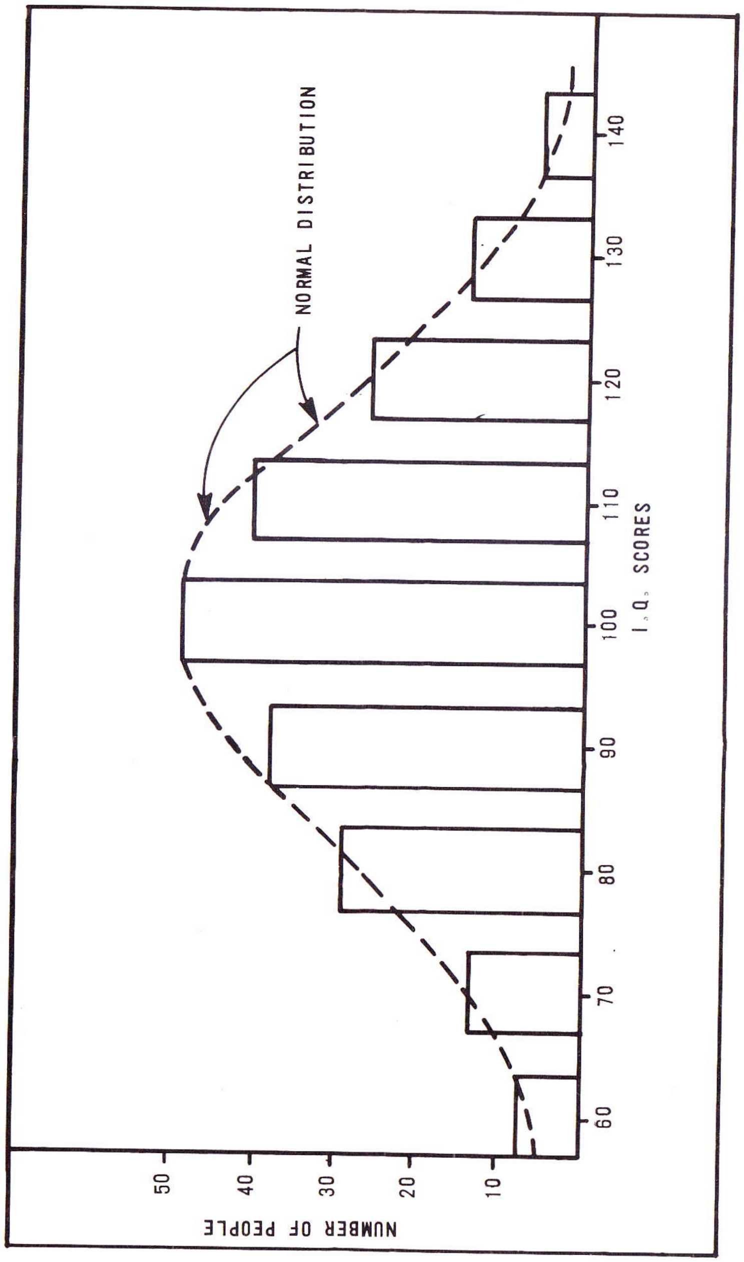

Figure XVI-7. Distribution of I.Q.'s

Binomial distribution

The binomial distribution describes *discrete* data. It arises when events depend upon a fixed probability of occurrence, p, and when the number of trials, n, is limited. For example, planners might be concerned with resupplying insurgents in a hostile area by an airdrop. They might know that the insurgents constitute only one-third of the total population ($p = \frac{1}{3}$). They would be interested in the likelihood of reaching at least 5 insurgent groups if 10 bundles of supplies were dropped.

Figure XVI-8 shows the binomial distribution when $n = 10$ and $p = \frac{1}{3}$.

In order to find the probability of reaching at least 5 groups of the target population when 10 bundles are dropped, the *additive law* of probability must be applied to the binomial distribution (see page 236):

$$\begin{gathered} Pr[\text{at least } 5] = \\ Pr[5] + Pr[6] + Pr[7] + Pr[8] + Pr[9] + Pr[10] \end{gathered} \tag{1}$$

$$\begin{gathered} Pr[\text{at least } 5] = .136 + .057 + .016 + .003 + .0003 + \\ .00002 = .21232 \end{gathered} \tag{2}$$

The probability of reaching at least 5 groups of the target population is only .21 or about 1 chance out of 5. Such a simple analysis does not take into account the size of either the *total* population or the *target* population. The population size would become important if, for instance, the objective of the mission were to reach at least 50 percent of the target population.

Exponential distribution

The exponential curve provides an accurate description of the likelihood of occurrence of an unlimited number of events.

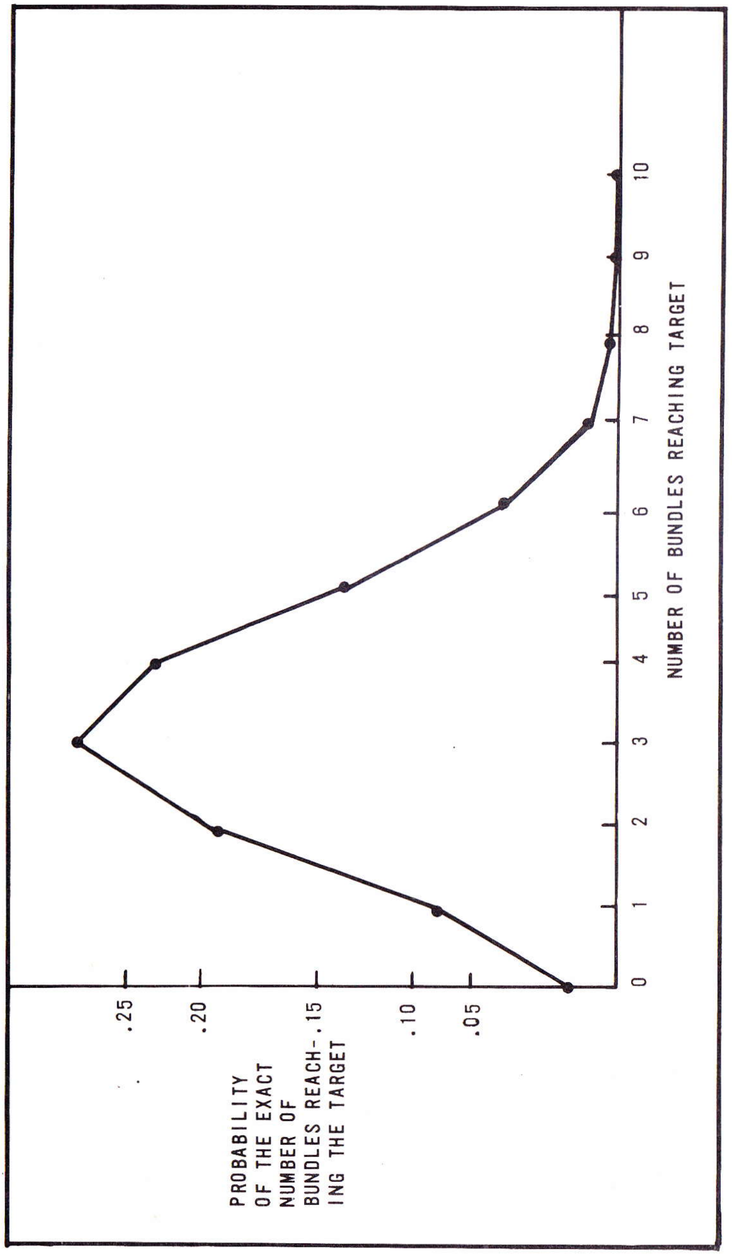

Figure XVI-8. An Example of a Binomial Distribution

For example, the length of time between the arrivals of aircraft on a carrier may be called an event. If 2 aircraft arrive simultaneously, the length of time between their arrivals is zero (0). Therefore,

$$\text{Event}_1 \text{ (time between arrivals)} = 0.$$

If the next aircraft arrives 2 minutes later, then

$$\text{Event}_2 \text{ (time between arrivals)} = 2.$$

In certain situations--for example, after an airstrike--it would be common for several aircraft to arrive at the carrier almost simultaneously. Therefore, the most common value for the event (time between arrivals) is zero (0). So, in a probability distribution describing aircraft arrivals, the value zero (0) has the highest probability. It is less probable for there to be 1 minute between arrivals and even less probable for there to be 5 minutes between arrivals.

The duration of a message transmission might also be called an event. It is most likely that a message will be of a very short duration, less likely that a message will last 3 minutes, and even less likely that a message will last 6 minutes. The duration of message transmissions is very well described by the exponential distribution.

Another common use of the exponential distribution is the description of the lifespan of pieces of equipment. For example (Figure XVI-9), all radio transmitters in a lot are checked before leaving the factory and all work properly. One year later most of them still work, but at the end of 4 years very few work (without having been repaired).

The choice of a particular distribution depends upon the nature of the phenomenon to be described. A duration of time, for example, is often described by the exponential distribution, whereas the apportionment of abilities is described by the normal curve. Probability distributions are powerful tools for prediction because they tell a researcher which values of an event are most likely to occur.

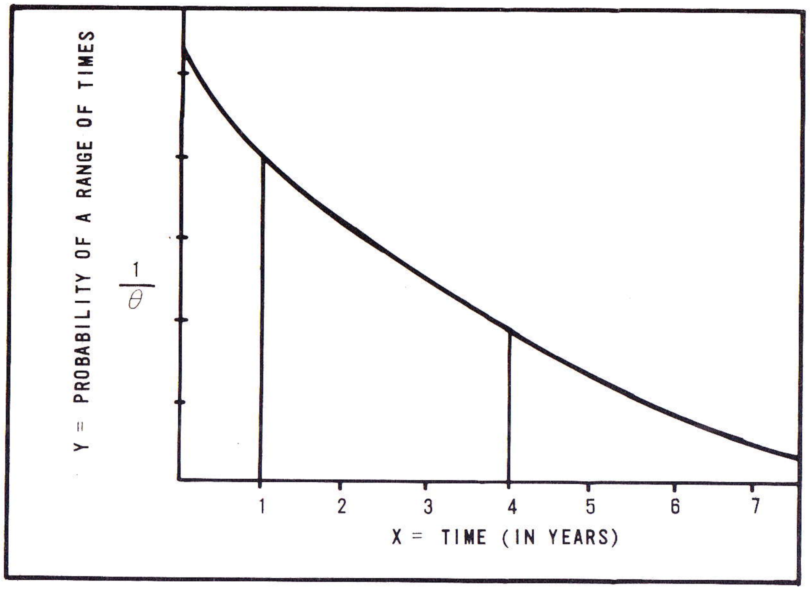

Figure XVI-9. An Example of an Exponential Distribution. . . Transmitter Lifespan

The intent of these brief descriptions is not to teach how to create or develop the distributions, but rather to describe types of distributions that might be highly relevant to a problem. For information on how to develop and apply these distributions, the reader should consult the references at the end of the chapter.

For more information about basic statistics, Lester Guest's *Beginning Statistics*[3], or L. H. Longley-Cook's *Statistical Problems and How to Solve Them*[4] would be useful. For the more advanced student of statistics, J. P. Guilford's *Psychometric Methods*[5], and Robert V. Hogg and Allen T. Craig's *Introduction to Mathematical Statistics*[6] would be appropriate. For the researcher who is also concerned with experimental design, B. J. Winer's *Statistical Principles in Experimental Design*[7] should be consulted, as should E. F. Lindquist's *Design and Analysis of Experiments in Psychology and Education,*[8] a classic in its field. Finally, for the novice and professional researcher alike, Darrell Huff's short and slightly irreverent book, *How to Lie With Statistics*[9], is most valuable for illustrating the uses and abuses of statistics for rhetorical purposes.

Summary

▷ Statistics is the science of collecting, analyzing, and drawing inferences from masses of numerical data.

▷ Quantitative data do not always require statistical analysis. At times a simple mathematical formula suffices for an analysis of quantitative data.

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[3]Lester Guest, *Beginning Statistics* (New York: Thomas Y. Crowell Company, 1957).

[4]L. H. Longley-Cook, *Statistical Problems and How to Solve Them* (New York: Barnes & Noble, Inc., 1970).

[5]J. P. Guilford, *Psychometric Methods* (New York: McGraw-Hill Book Company, Inc., 1954).

[6]Robert V. Hogg and Allen T. Craig, *Introduction to Mathematical Statistics* (New York: The Macmillan Company, 1970).

[7]B. J. Winer, *Statistical Principles in Experimental Design,* 2nd ed. (New York: McGraw-Hill Book Company, Inc., 1971).

[8]E. F. Lindquist, *Design and Analysis of Experiments in Psychology and Education* (Boston: Houghton Mifflin Company, 1953).

[9]Darrell Huff and Irving Geis, *How to Lie With Statistics* (New York: W. W. Norton & Co., Inc., 1954).

▷ Descriptive statistics permit a researcher to create an image of the data distribution. Descriptive statistics include:

- Frequency distributions (or profiles of data values)
- Histograms (frequency distributions in the form of bar graphs)
- Measures of central tendency: mean, mode, and median
- Measures of dispersion or spread of data: standard deviation and coefficient of variation, and others

▷ Sampling theory allows one to generalize about population characteristics on the basis of an analysis of only a small part of the population.

- Two common sampling types are random sampling and stratified sampling.
- An advantage of random sampling is that it permits one to ascertain how likely it is that the sample has similar characteristics to the whole population.

▷ Probability theory provides the mathematical foundation for inferential statistics.

- Probability theory makes it possible to generate "ideal" distributions of data for purposes of comparison with actual distributions of data
- Three common distributions are illustrated by the normal, binomial, and exponential curves

CHAPTER XVII
DESCRIPTIVE ANALYSIS METHODOLOGIES

As our graph shows, Trends are trending. This is good. Yet, nevertheless, the destination of the trendings is not simple to assess.

Dr. Seuss

Descriptive and predictive research constitute the major types of intelligence analysis and research activities, as pointed out earlier. Just as the distinction between description and prediction is somewhat tenuous, so are distinctions between descriptive and predictive methodologies tenuous.

It will be recalled that, strictly speaking, the term "predictive research" should be limited to those activities relating to developing and validating conceptual models which could be applied to a variety of future-oriented problems. But in order to develop models, the phenomenon being "modeled" first must be described. In short, description is the basis of all intelligence research.

This chapter and the next discuss various methodologies that are or can be used in strategic intelligence production. This chapter addresses methodologies that are used for *descriptive* or *analytic* purposes. The next chapter will address methodologies that are used more commonly for *predictive* purposes even though they may be essentially descriptive. Some of the methodologies described in the next chapter relate to developing conceptual models. Developing, validating, and applying these conceptual models to a variety of different problems qualifies as predictive research in the most rigorous sense. Other methodologies described in the next chapter may be equally

suitable for descriptive *or* predictive research but tend to be used more commonly for predictive purposes.[1]

Specific instructions on how to apply the techniques to numerous types of intelligence problems are beyond the purview of this chapter and the next one, because an entire volume might be required to describe adequately any one technique. As such, this chapter and the next one should be considered as overviews of representative methodologies. For specific information on how to apply any given technique, the references cited should be consulted.

Analogy: The Perennial Analytic Model

One of the most widely used tools in intelligence analysis is the analogy. Analogies serve as the basis for constructing many predictive models, are the basis for most hypotheses, and rightly or wrongly, underly many generalizations about what the other side will do and how they will go about doing it.

Very briefly, analogies relate to the real or presumed *similarities* between two things. In an example cited earlier, analysts or researchers might reason that because two aircraft have many features in common, they may have been designed to perform similar missions. The form of this reasoning looks like Figure XVII-1.

Some analogies are better than others depending upon what is known about the properties that two objects, events, or conditions have in common. Aside from superficial external similarities, if it were known that two aircraft were powered by

[1]The methodology referred to as "The Generation of Alternative Futures" in the next chapter is a case in point. There is nothing in the methodology that involves developing and validating conceptual models, and the products of the methodology are scenarios (descriptions) of future conditions that might exist if certain events were to occur. However, this methodology is employed in future-oriented problems, and not for description of current situations.

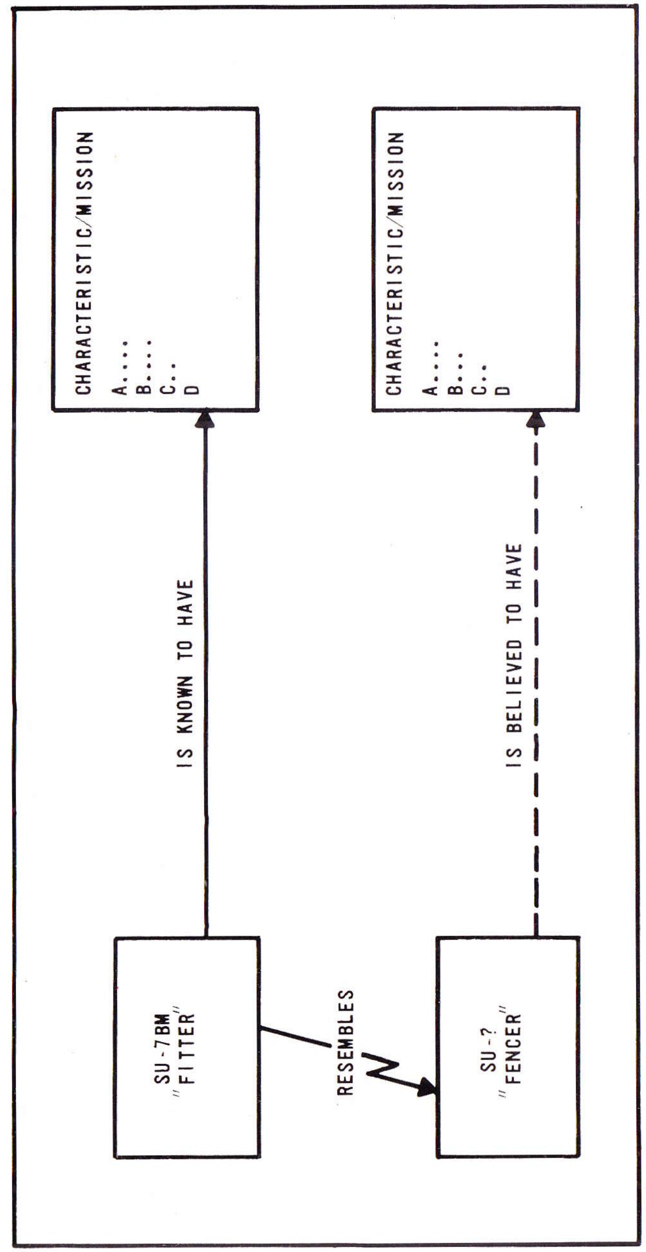

Figure XVII-1. Basic Analogy Model[2]

[2]The analogy models are based on the discussion presented by Max Black in *Critical Thinking: An Introduction to Logic and Scientific Method* (New York: Prentice-Hall, Inc., 1946), pp. 291-297.

similar engines and if the performance characteristics of one engine were known, then the performance of the "unknown" aircraft could be inferred fairly reliably. The strength of this argument derives from the fact that the performance of the aircraft is logically *connected* to the quality of its engine. It is the ability to establish the cause-and-effect relationships or the invariant relationships between qualities and capabilities that ultimately determines the strength of analogies.

In the case of inferring the capabilities of an "unknown" aircraft on the basis of associated qualities, the argument would look like Figure XVII-2.

The key to reasoning from analogy revolves around the bases that are used to establish similarities, The "force" of an argument from analogy is a function of how well *connections* (or "linking generalizations") can be established. If the connection between a given condition and a specified result is a strong one, then a good case can be made for a generalization drawn by analogy.

But an important part of reasoning by analogy is to consider also those conditions, qualitites, characteristics, and so on, that are *dissimilar* between two phenomena. It may well be the case that the dissimilarities are so great that the similarities that do exist are negligible.

Analogies are used in many different kinds of intelligence analyses from military and political to industrial intelligence. For example, major U.S. auto makers purchase their competitors' models as soon as they appear in the showrooms. The new cars are taken to laboratories where they are completely and methodically disassembled. Each component, regardless of how seemingly insignificant it might be, is priced. The aggregate price for all of the parts collectively represents the material costs of producing one unit. To these costs would be added overhead, labor, and profit rates—rates which are generally similar throughout the industry. Reasoning by analogy, i.e., assuming that it would cost one producer the same amount to produce or purchase the same components used by another, the

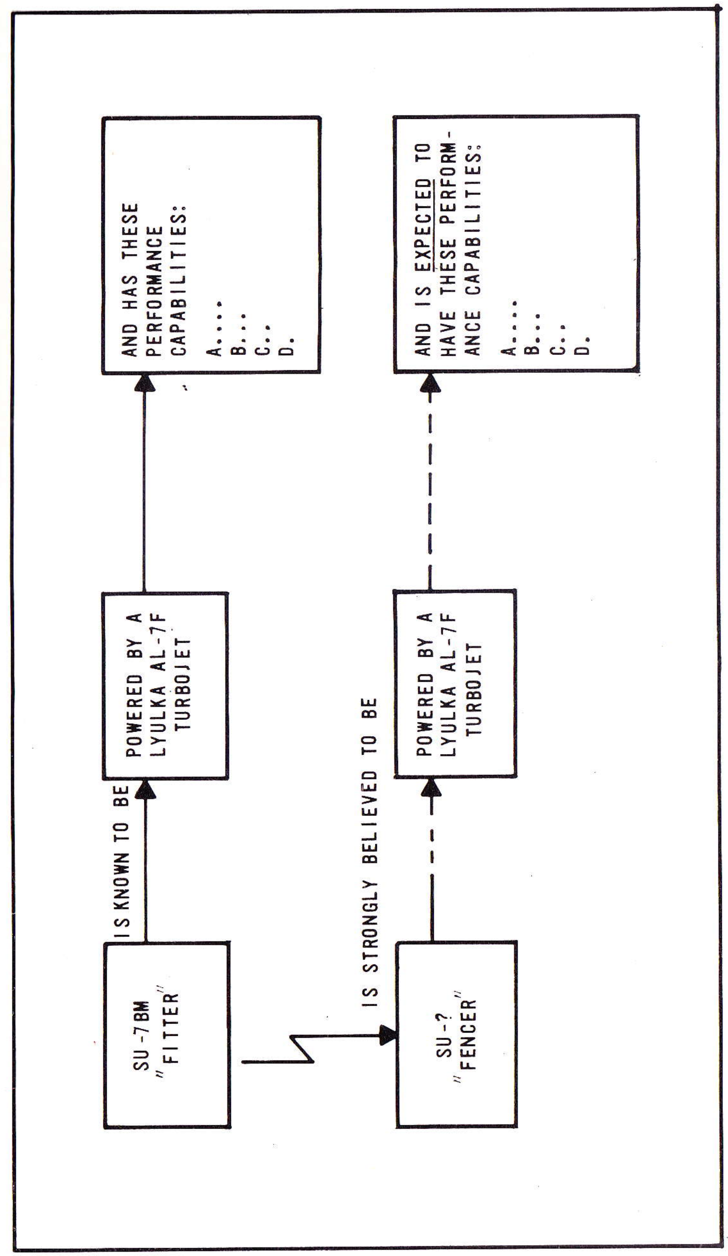

Figure XVII-2. Strong Analogy Model

major auto producers can estimate their competitors' per-unit production costs, any cost-saving measures taken, and how much profit is earned by the sale of a single unit.

The strategic intelligence counterpart of this example (which is also an analogy) is not hard to envision. What confounds the problem in intelligence production, however, is establishing currency equivalences. General Motors, Ford Motor Company, and Chrysler all use the same currency. However, determining the rate of exchange between the *yaun* or the *ruble* and the U.S. dollar is a different matter.

Analogies may be economic, (as in the example just described), physical (as was the case in the comparison of aircraft), or historical (as will be shown in the next chapter when Max von Hoffman predicted the behavior of two Russian generals on the basis of previous behaviors). Reasoning by analogy is fairly common in Economic Intelligence, in Scientific and Technical Intelligence, and, to a lesser degree, in Political, Biographic, and Armed Forces Intelligence. The technique is useful, but it must be used guardedly. In the excitement of discovering superficial similarities between phenomena, it is very easy to overlook the significant differences that may exist as well.

Link Analysis

Link analysis is an analytic technique for making relationships explicit. The technique was first used in human factors research but has since been applied to problems of social analysis as well. The technique requires the preparation of an association matrix and a link diagram based on the matrix. For example, based on a variety of intelligence reports, a matrix showing the confirmed and suspected associations of a number of individuals might be prepared as shown in Figure XVII-3. A solid dot represents a strong link (a confirmed association), and an open dot represents a suspected association. (No dot represents no known or suspected association.)

Based on the matrix, a link diagram can be prepared (Figure XVII-4). The solid lines represent strong (or confirmed) links; the broken lines indicate weak (or suspected links). No lines, of

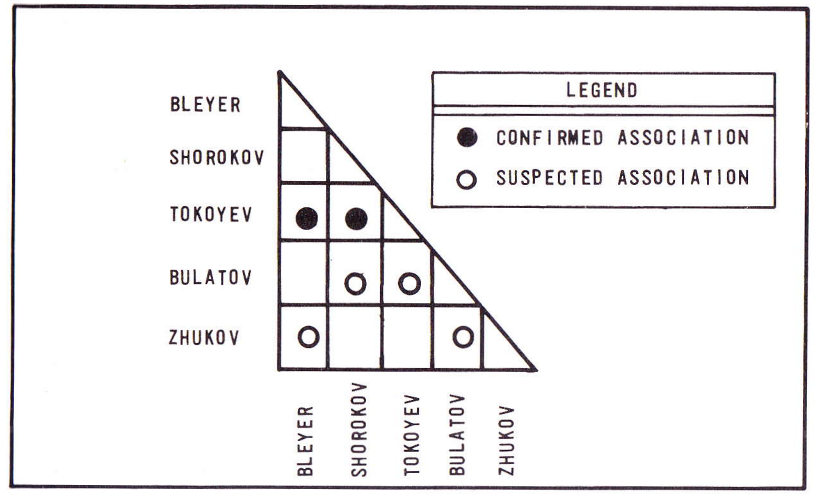

Figure XVII-3. Association Matrix

course, indicate that no association had yet been established. The link diagram can be enhanced further by superimposing organizational structures on the personnel linkages as shown in Figure XVII-4.

Link analysis can be used to construct inferential structures of organizations or interactions which can be tested later. It is very well suited for hypothesis construction and can be applied to a variety of problems in Armed Forces Intelligence (e.g., orders of battle), in Political Intelligence and in Sociological Intelligence research and analysis.[3]

[3]For more information, see Walter R. Harper and Douglas H. Harris, "The Application of Link Analysis to Police Intelligence," *Human Factors* 17 (April 1975): 157-164.

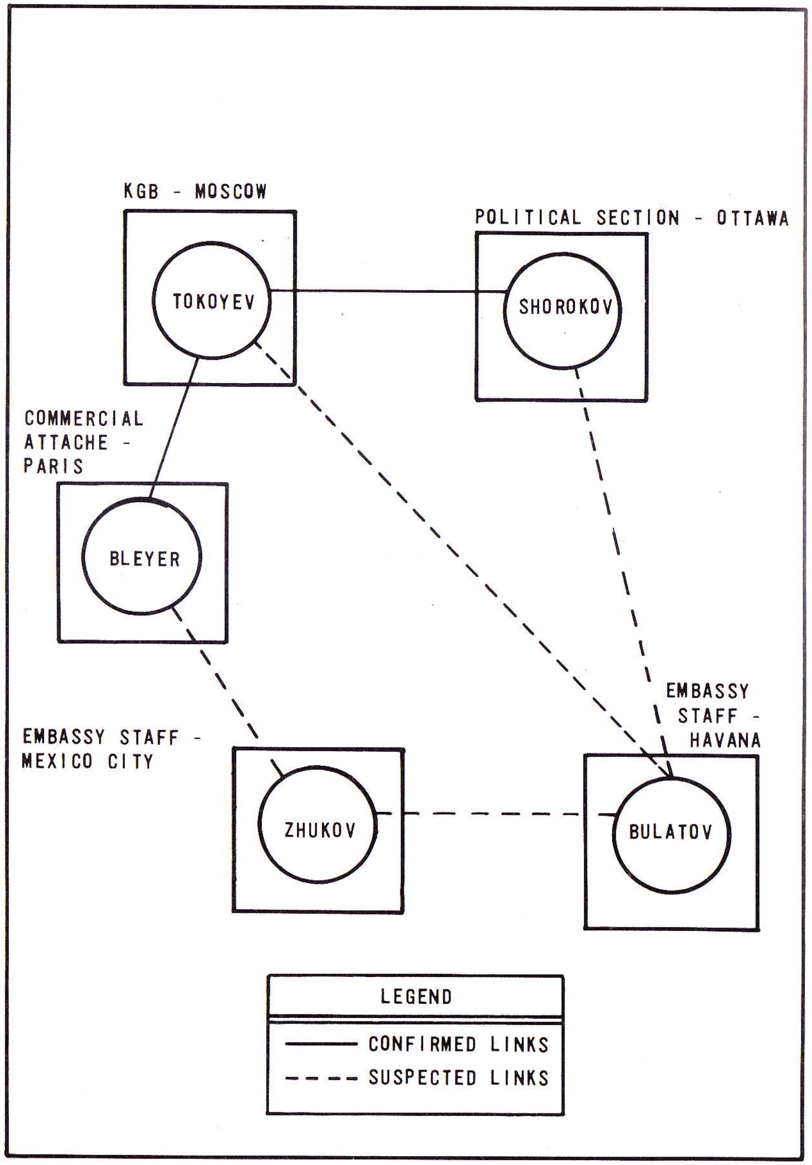

Figure XVII-4. Link Diagram with Organizations and Personnel

Sociometry

In its applications to problems in social psychology, sociometry relates to techniques for depicting graphically the structure of relationships within a group. An organization chart may depict formal relationships among elements within an organization; however, organization charts do not reveal who actually talks to whom. Sociometric depictions—sociograms—do reveal the actual patterns of lines of communications and interaction.

Given access to a group, interactions can be measured directly by observational techniques, or they can be measured by use of scaling devices such as questionnaires that would be administered to members of a group. However, the types of groups that are of primary interest to the intelligence analyst or researcher are generally groups to which the researcher has only limited access. Consequently, the more conventional measuring techniques cannot be used.

One crude sociometric technique, however, might involve counting the number of instances in which a government official interacted with other officials at a formal reception. (But preparing a sociogram of this behavior would be of questionable value because a formal reception is an artificial situation and important people may talk to unimportant people as a matter of courtesy.)

Another crude sociometric procedure would be to count the number of times certain names appeared in state-controlled mass media. Of course, the manner in which names are treated, i.e., positively or negatively, must also be taken into account. The assumption in this type of analysis is that there is a direct correlation between the number of times a name appears or is mentioned and its importance.

In instances in which behavior can be observed—a researcher analyzing communication traffic, for example—records could be made of who interacts with whom and who initiates the interaction. Observations could be recorded as shown below in Figure XVII-5.

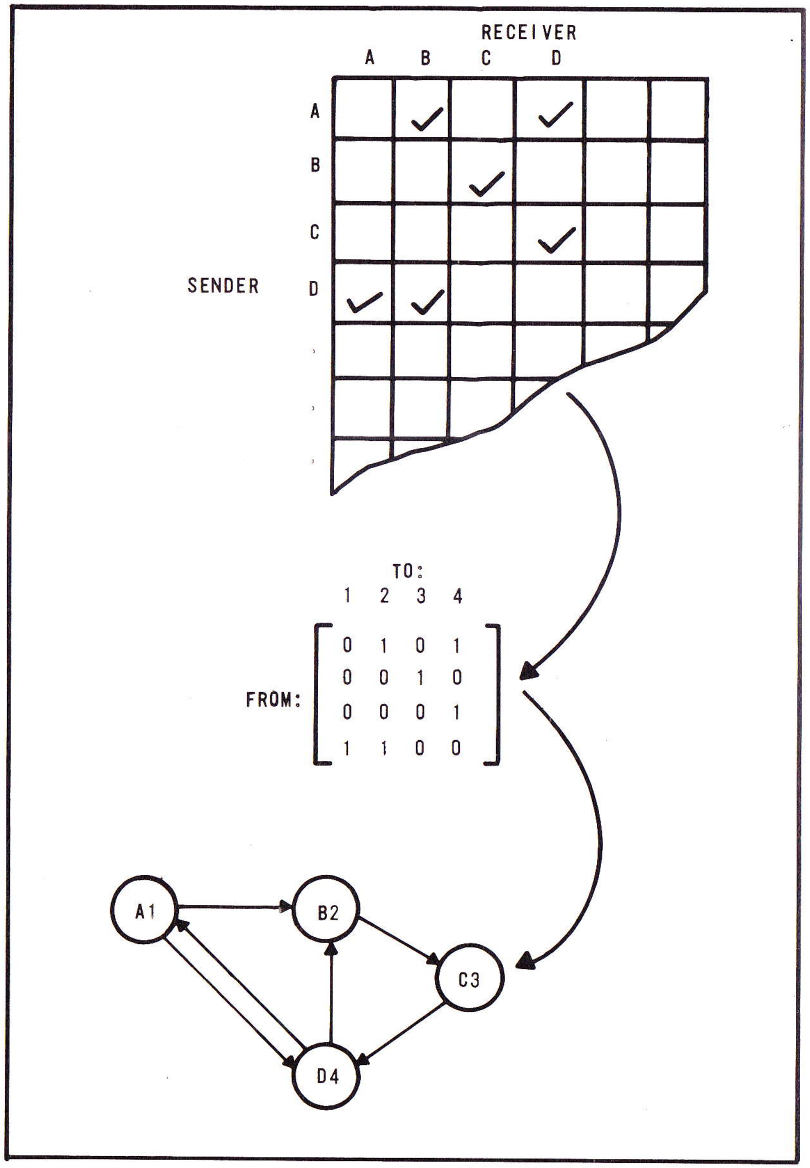

Figure XVII-5. Observation Checklist Converted into a Sociogram

In Figure XVII-5, the observations are recorded initially as check marks placed at the matrix intersection of the sender and receiver. The check marks are converted to ones and zeroes in the second matrix. This representation is necessary if matrix multiplication is to be used to determine the number of indirect connections between various senders and receivers. In the example above, for instance, if the matrix were squared, then the ikth element of the new matrix (a'_{ik}) would be:

$$a'_{ik} = \sum_{j=1}^{n} a_{ij}\, a_{jk}$$

In the example above, the element $a_{i,2} = 0 \times 1 + 1 \times 0 + 0 \times 0 + 1 \times 1 = 1$. In other words, there is only one indirect connection between elements 1 and 2. (Element 4 is the link, e.g., 1→4→2. Inspection shows, however, that there is also one *direct* connection between elements 1 and 2.)

This example, of course, is simple, and the linkages could be determined directly from the sociogram without too much difficulty. However, if the number of elements were great or if the analyst were concerned with determining various degrees of connectivity, then matrix multiplication would be necessary.

Another crude sociometric technique is to assess the significance of an individual on the basis of his proximity to the leader. For example, for years Lin Piao, the former heir apparent to Mao Tse Tung, could be seen standing next to Mao on reviewing stands, and the vicissitudes of Chou En Lai could be observed (if not measured) by the number of other Chinese officials who would stand between Chou and Mao. The rank-ordering of Soviet and Chinese officials at affairs of state—parades, funerals, reception lines, and so on—has been used widely as a crude sociometric device for establishing the relative prestige and importance of the individuals. Literally and figuratively, in the Soviet Union and in the People's Republic of China, people who fall from power fade out of the picture.

Sources that might be consulted for additional information about sociometry include Helen Hall Jennings, *Sociometry in Group Relations*[4] and *Leadership and Isolation*.[5] A more recent work, and the work used as the basis for the example cited in this section, is James S. Coleman, *Introduction to Mathematical Sociology*.[6]

Sociometric techniques can be used in Political Intelligence, in Sociological Intelligence, in Armed Forces Intelligence (e.g., orders of battle, traffic analysis), and conceivably in Biographic Intelligence.

Game Theory

Game theory is basically a theory of decision making by participants in a *conflict* or *competitive* situation. In a competitive situation, each participant attempts to "influence in the action" in such a manner that the outcome is an optimal one for him. Game theory permits the decision maker to select an optimal course of action in light of the number of options available to each player and in light of the "rules" by which the options can be exercised. An optimal course of action is one which maximizes the player's probability of success and minimizes his probability of failure or loss.

Games can be classified according to the number of players and according to the nature of the payoff. With respect to payoff, games are classified as either zero-sum games or non zero-sum games. A zero-sum game is one in which the outcome of the game is a "win" for one participant and a "loss" (of equal value) for the other. Translating game theory terminology to a real world conflict situation, an unconditional surrender

[4]Helen Hall Jennings, *Sociometry in Group Relations* (Washington, D.C.: American Council on Education, 1948).

[5]_______, *Leadership and Isolation* (New York: Longmans, Inc., 1943).

[6]James S. Coleman, *Introduction to Mathematical Sociology* (New York: The Free Press, 1964).

would be an example of a zero-sum conclusion, and a "negotiated settlement" would be an example of a non zero-sum outcome.

Policy makers, disarmament negotiators, planners, and field commanders all use game theory in one form or another. For example, when a field commander makes his estimate of the situation and then chooses an appropriate course of action, he is using game theory. Although it is seldom done in the field, an estimate of the situation can be expressed mathematically in a series of matrices. The advantage of the mathematical depiction is that sometimes an optimal strategy becomes apparent that otherwise might be overlooked.

A very basic example of strategies and payoffs is shown in the matrix below (Figure XVII-6). Blue's strategies and payoffs are shown in the rows; Red's strategies and losses are shown in the columns. In the example below, Strategy #1 for Blue could pay off 7 or 5, whereas Strategy #2 would yield 5 or only 3. From the standpoint of maximum gain, Strategy #1 would be better for Blue. But Red can influence the outcome as well. For example, if Red would select Strategy #1, Red could lose 7 or 5. However, by selecting Strategy #2, Red could lose 5 or only 3. Obviously, Strategy #2 would be better for Red. In Strategy #2, Red's losses would never exceed 5, and they might be as low as 3.

In this example, the optimal choice for *both* sides would be a combination of Blue's Strategy #1 and Red's Strategy #2. This combination will guarantee that Blue's payoff will be *at least* 5, and it guarantees that Red's losses *will never exceed* 5. When a single value exists that is at the same time the minimum value in a row, and the maximum value in a column, the value is called a *saddle point*. In conflict situations, saddle points are usually the places where negotiations would prove most profitable to both sides.

If the payoff matrix in the example just cited contained other values (e.g., Figure XVII-7), no saddle point would exist.

		RED STRATEGY #1	RED STRATEGY #2
BLUE	STRATEGY #1	7	5
	STRATEGY #2	5	3

Figure XVII-6. An Example of a Two-Person Game Matrix

In a case such as this, each player should adopt a mixed strategy by using each strategy a certain percentage of the time in order to maximize his gains and minimize his losses.

The percentage of the time a strategy should be used by a player is derived in the following manner: 1) each player takes the absolute difference between the payoffs associated with each strategy. For Blue, $|7 - 3| = 4$, and $|5 - 6| = 1$. For Red, $|7 - 5| = 2$, and $|3 - 6| = 3$. 2) The differences between payoffs are summed for each player. 3) Each player calculates a proportion derived from each strategy, and assigns that proportion to the alternate strategy. Therefore, Blue should play Strategy #1 one-fifth of the time and Strategy #2 four-fifths of the time. Red, on the other hand, should play Strategy #2 three-fifths of the time, and Strategy #2 two-fifths of the time (Figure XVII-8).

		RED STRATEGY #1	RED STRATEGY #2
BLUE	STRATEGY #1	7	3
	STRATEGY #2	5	6

Figure XVII-7. An Example of a Two-Person Game Matrix with No Saddle Point

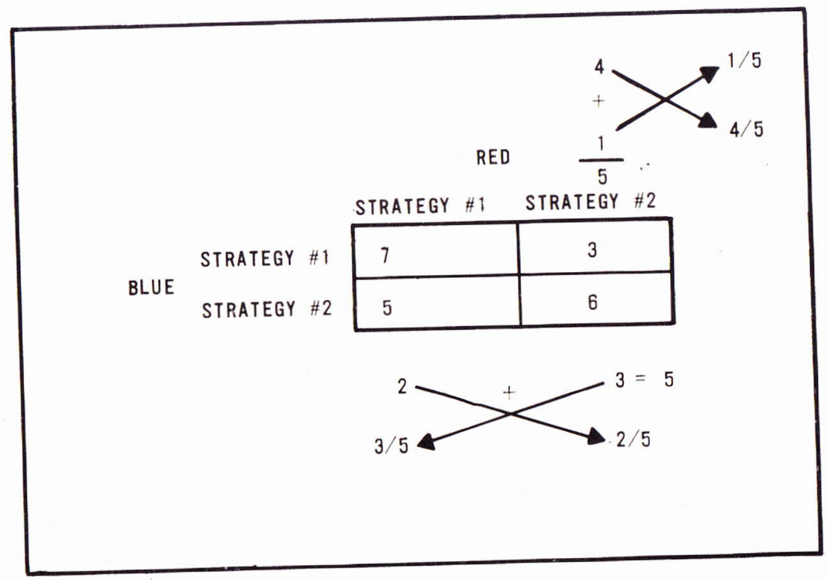

Figure XVII-8. Payoffs with a Mixed Strategy

Assuming that Blue always wishes to maximize his gains and that Red always wishes to minimize his losses, the expected payoff for Blue would be obtained by multiplying the values in column 1 by the proportions of the time Blue played each strategy, or

$$(7 \times \frac{1}{5}) + (5 \times \frac{4}{5}) = \frac{27}{5}$$

Column 2 gives the same result, i.e.,

$$(3 \times \frac{1}{5}) + (6 \times \frac{4}{5}) = \frac{27}{5}$$

Likewise, for Red, the expected loss would be obtained similarly, e.g.,

$$(7 \times \frac{3}{5}) + (3 \times \frac{2}{5}) = \frac{27}{5}$$

and

$$(5 \times \frac{3}{5}) + (6 \times \frac{2}{5}) = \frac{27}{5}$$

Since this is a zero-sum game, Red's losses always equal Blue's gains in the long run. In a mixed strategy solution, each strategy must be chosen randomly if the calculated payoff is to result.

To the reader who is unfamiliar with game theory, it may come as a surprise to discover how complex a seemingly simple game may become. For example, in the game of "Morra" in which each of two players shows 1, 2, or 3 fingers and at the same time guesses the number of fingers his opponent will show, each player has 9 choices of strategy. And the possible combinations of payoffs for both players is 81.[7]

In "gaming" a situation in which an aircraft loaded with a certain mix of electronic devices would be flown (symbolically)

[7]There are 9 strategies for each player: hence, a square matrix with 9 rows, 9 columns, and 81 payoff squares.

against a target with another mix of electronic detectors and fire control devices, the combination of choices and payoffs (i.e., combinations which would optimize the chances of the aircraft's reaching the target undetected) could be of such magnitude that a computer would be necessary in order to identify the optimal mix. It is for this reason that computers are usually used in major war gaming exercises.

Game theory, as developed by John von Neumann and Oskar Morgenstern, tends to be highly mathematical and addresses conflict primarily in the economic sense. Since the publication of their *Theory of Games and Economic Behavior*,[8] however, game theory has been applied to military and political conflicts as well. Perhaps the most popular and essentially nonmathematical treatment of game theory related to political and military problems can be found in Thomas C. Schelling's *The Strategy of Conflict*.[9]

Other works that might be useful to the intelligence researcher include J. D. Williams, *The Compleat Strategyst*[10] (an excellent book for the researcher unfamiliar with game theory); Melvin Dresher, *Games of Strategy*[11]; and J. C. C.

[8]John von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behavior* (Princeton: Princeton University Press, 1947).

[9]Thomas C. Schelling, *The Strategy of Conflict* (Cambridge, Massachusetts: Harvard University Press. 1963).

[10]J. D. Williams, *The Compleat Strategyst: Being a Primer on the Theory of Games* (New York: McGraw-Hill Book Company, Inc., 1954).

[11]Melvin Dresher, *Games of Strategy: Theory and Applications* (Englewood Cliffs, New Jersey: Prentice-Hall, Incl, 1961).

McKinsey, *Introduction to the Theory of Games.*[12] A short, humorous, but not at all trite book on game theory is John McDonald's *Strategy in Poker, Business and War.*[13]

Game theory is basic to simulations involving conflict, e.g., war games. Although game theory is not a predictive technique *per se*, its application does permit the researcher to anticipate appropriate strategies for all players. Assuming that all players of the game were rational and that the players would opt for the minimax solution—the solution which minimizes the chances for loss and maximizes the chances for success—game theory can be used as a basis for predicting outcomes given certain conditions of conflict.

War Gaming

War games are experiments with alternative tactics and strategies in a conflict situation.[14] Participants in war games often use game theory, but game theory and war gaming are not synonomous. *Game theory* relates to techniques of selecting optimum strategies. *War gaming* involves the applications of various strategies under various constraints in conflict situations. Game theory, in short, provides the theoretical basis for war gaming. One can utilize game theory apart from war games, and war games can be played without a mathematical analysis of payoffs.

Three terms are used typically in the discussion of war games: *games, model,* and *simulations*. Very briefly, a *game* is a contest played according to rules and decided by skill, strength,

[12]J. C. C. McKinsey, *Introduction to the Theory of Games* (New York: McGraw-Hill Book Company, Inc., 1952).

[13]John McDonald, *Strategy in Poker, Business and War* (New York: W. W. Norton & Company, Inc., 1950).

[14]As the term is used in this context, war games would include any type of *conflict* simulation. By this definition, simulations of political, economic, and technological conflict would be considered variations of war games as are the more familiar military conflict simulations or *Kriegspiele*.

or chance. Games are essentially symbolic conflicts. No one gets hurt in the symbolic conflicts, but lessons can be learned from these conflicts nevertheless. A *model,* on the other hand, is a representation of an object or a process. For example, a mockup is a model of a real piece of equipment, and a flow chart is a model of a process. *Simulations*, finally, are dynamic imitations of processes. To put it another way, a simulation is a dynamic model.

War games can be classified according to the extent to which they are abstract. Army-wide games in which units actually maneuver on the terrain and engage each other represent one end of a continuum. Computer simulations of conflict represent the other end. In the middle of this continuum are any number of combinations of realistic and symbolic analogs. A command post exercise (CPX) may be considered a war game, but other than the command posts, no subordinate units move physically. The "enemy" in a war game may consist of human "Aggressor Force" personnel, or the enemy may consist simply of unit designators and numerical indications of strength given to the players in writing or displayed electronically on a cathode ray tube (CRT).

The outcome of a game may be determined by the umpires on the ground who observe the action and ostensibly make objective judgments, or the outcome may be determined by the mathematical manipulation of variables according to some theoretical and, ideally, validated model.

The nature of the game to be played determines the nature of the steps involved in the design of the game. For example, a game could be a man-to-man game which would involve the actual movement of forces; or it could be a computer-assisted game, probably played on maps, in which a computer performed the clerical duties associated with games—duties such as scoring, determining kills, and keeping time. Or the game could be a man-machine game in which the machine made all of the evaluations and determined outcomes on the basis of the values submitted, tactics or strategies used, and on the basis of the rules of play which were programmed into the computer.

In the first type of game, a scenario could be prepared and given to the players. The scenario would describe the general situation, perhaps a general order of battle, the respective missions of the two (or more) sides, and the rules of play. Upon receipt of the general plan, the forces would move to the field. Umpires who accompanied the opposing sides would do the scoring, make kill determinations, and perform other bookkeeping functions manually. The computer-assisted and man--machine games, on the other hand, would require the preparation of a series of mathematical or logical models which would represent certain sub-elements of the conflict; for example, a model of a surface-to-air-missile engaging an aircraft, or an antisubmarine warfare model, and so on. Developing these kinds of games requires a sequence of steps which include 1) defining the action to be gained; 2) identifying and classifying variables in terms of significance; 3) identifying and quantifying relations among variables; 4) designing the model (initially in flow chart form) and translating the model into computer instructions; 5) specifying tradeoffs for the models and programming the computer accordingly; and 6) collecting real-world data for the purposes of obtaining realistic values for variables and for validation purposes (i.e., for determining if the simulated conflict did in fact yield outcomes that a genuine conflict situation would yield).

War games involving international conflict may require months, if not years, of preparation in order to develop models that would address the numerous sub-elements involved in such a conflict; for example, the military, political, and economic factors and their major interactions. Typically, as war games become "more global," they also tend to become more general simply because the costs in modelling anything less than a major element of the conflict in fairly general terms would become prohibitively expensive. Furthermore, the nature of the game play also tends to become more complex when numerous sub-elements are addressed.

With respect to the predictive value of war games, the point made earlier in the discussion of game theory applies: a war game can only determine the statistical probability of an event's

occurring given certain variables and rules for manipulating these variables.[15] Games serve an excellent diagnostic purpose by identifying which variables have the greatest effects on the outcomes, however. Aside from their values as training mechanisms and as a research vehicle, games are usually used to evaluate various courses of action in order to arrive at conclusions with respect to plans and policies.

An excellent overview of war gaming is presented in Clark C. Abt's article, "War Gaming," in *International Science and Technology*.[16] Other sources include Melvin Dresher's *Games of Strategy*,[17] R. Duncan Luce's and Howard Raiffa's *Games and Decisions*,[18] and Thomas C. Schelling's *The Strategy of Conflict*,[19] mentioned earlier in the discussion of game theory. Personnel of the Studies, Analysis and Gaming Agency, Office of the Joint Chiefs of Staff, could also describe specific types and applications of games used for joint planning purposes.

[15] One of the authors recalls observing a week-long war game played at the Naval War College in which the outcome of an engagement depended upon "Green's" forces detecting "Red's" surface units. A reconnaissance flight failed to detect the presence of "Red's" forces, and in the ensuing battle, "Green" was "defeated." Having access to both the "Red" and the "Green" side as well as to the master display (which the players did not), the author noted that the success of that single, critical flight was determined by one run of an analog computer. That single computer run (or toss of the dice) would hardly permit anyone to state unequivocally that "Red's" deployment and tactics were necessarily better than "Green's," but it did drive home dramatically the importance of that single reconnaissance mission.

[16] Clark C. Abt, "War Gaming." *International Science and Technology* (August 1964): 29-37.

[17] Dresher, *Games of Strategy*.

[18] R. Duncan Luce and Howard Raiffa, *Games and Decisions* (New York: John Wiley & Sons, Inc., 1957).

[19] Schelling, *Strategy of Conflict*.

Linear Programming

Goals can sometimes be expressed in terms of achieving a maximum payoff for a minimum investment or risk. For example, an investor might want to receive the maximum number of dollars return on his investment; a manufacturer might want to produce the maximum number of units with a minimum amount of material, and a purchaser might want to buy the most or the best of a commodity for the least amount of money. *Linear programming* is a method which allows one to find a maximum or a minimum point (optimum point) to satisfy a goal (objective).

In nearly every type of operation (or organization), there are limitations or constraints upon the use of time and resources. If the limitations can each be expressed by the equation of a line, or

$$y = ax + b \tag{1}$$

then linear programming may be used to find an optimum solution.

For example, the operations officer of a PSYOP unit that was operating a strategic radio broadcasting facility could use linear programming to maximize the number of potential listeners in light of certain operational constraints. His basic objective would be to maximize the size of the target audience that would hear spoken commentary since the PSYOP "message" would be transmitted in this commentary. However, he realizes that the best way to gain and to hold his target audience's attention is to play traditional and popular music. Commentary, therefore, would have to be interspersed between musical selections.

If the broadcast day were defined as a mixture of time devoted to music and commentary, the proper proportions of each type of broadcasting can be discovered by solving a simple linear programming problem.

Initially, the operations officer notes that his broadcast day is 12 hours long and that it will be divided into two types of broadcasts. The broadcast day is described by the linear equation

$$12 \geqslant x + y \tag{2}$$

where x equals the number of hours per day devoted to commentary, and y equals the hours devoted to music (Figure XVII-9).

The next limitations placed upon the program day are that there must be no fewer than 5 but no more than 10 minutes per hour reserved for commentary. These limitations must be converted to the same units (hours) in order to be graphed. The two equations to describe these limitations are

$$x \geqslant 1 \tag{3}$$

$$y \leqslant 2 \tag{4}$$

since 5 minutes per hour equals 1 hour per 12-hour day, and 10 minutes per hour equals 2 hours per 12-hour day.

Finally, the number of man-hours available to prepare the broadcasts is limited. There are 18 hours of labor available each day. It only takes 1 hour to prepare 1 hour of music, but it takes 5 hours to prepare 1 hour of commentary (actually, the preparation of commentary consumes about 15 hours for each hour of broadcast time, but it can be assumed that each message is repeated 3 times). The equation to describe the labor constraint is

$$18 \geqslant 5\,x + y \tag{5}$$

After all of the important constraints are specified, the original objective must be expressed in terms of the common units (hours in this case). Since the objective is to maximize the number of listeners to the station, something must be known about how different kinds of programs attract listeners. In the

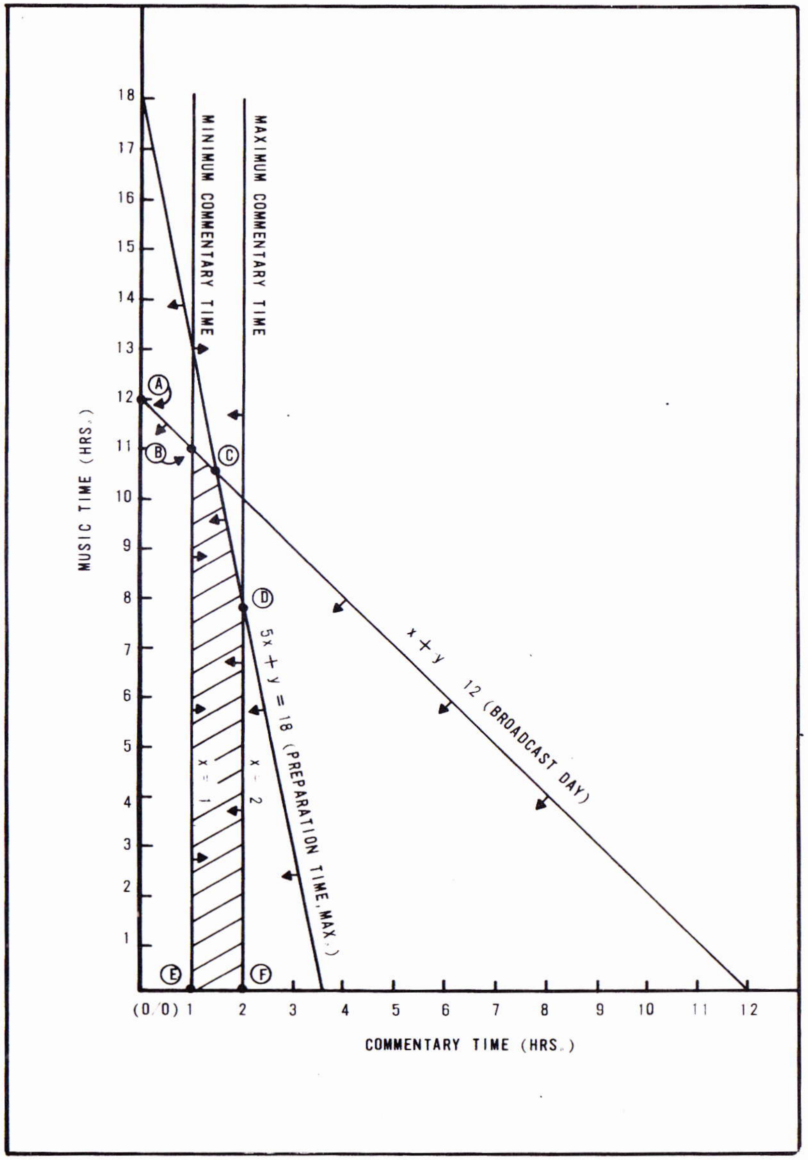

Figure XVII-9. Graph of Optimal Programming with Imposed Constraints

current example, it is assumed that music is 20 times as likely to attract and hold listeners as commentary.[20] Therefore, the total number of listeners would be a function of the number of commentary hours, plus 20 times the number of music hours, times a constant, or

$$N = k(x + 20y) \tag{6}$$

The only points which are permissible solutions for the objective function are those which fall within the boundaries of all the constraints. For example, points B, C, and D as well as all the points in the shaded polygon (Figure XVII-9) are allowable mixtures of music and commentary programming. Point C is on the line $x + y = 12$ which means it uses up all 12 hours of programming. It is also the line $5x + y = 18$, which means it uses up all 18 hours of labor. Point C also falls between the limits of 5 and 10 minutes of commentary per hour.

Point A, on the other hand, is not a valid solution because it allows no time for commentary and, therefore, violates the constraint of $x \geqslant 1$. It does satisfy the other two constraints and would be a valid solution if the $x \geqslant 1$ constraint were abandoned.

Linear programming theory also states that optimal solutions for the objective function are found at a *corner* or the polygon of acceptable solutions. The five corners of the polygon in the current example are B, C, D, E, and F. The only way to determine *which* corner is the optimal solution is to solve equation (6) at each corner (Table XVII-1).

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[20] This ratio is not unrealistic. In countries where listening to foreign broadcasts is prohibited, radio programming which utilizes the maximum amount of music for the minimum amount of spoken commentary poses the least risk of detection for the surreptitious listener.

Table XVII-1. X and Y Values of Five Points

POINT	x VALUE	y VALUE	$K(x + 20y) = N$
B	1	11	221K
C	1.5	10.5	211.5K
D	2	8	162K
E	1	0	1K
F	2	0	2K

Clearly, the value of N is maximized at point B (N=221K). Therefore, the maximum number of listeners would be achieved when the program consisted of 1 hour of commentary, or 5 minutes per hour, and 11 hours of music. Point B solution, although it uses the entire 12-hour broadcast day, does not require the 18 hours preparation time. In fact, it requires (equation 7) only

$$5(1) + 11 = 16 \qquad (7)$$

16 hours of labor.

The example of radio broadcasting contained in this explanation is much simpler than most real world linear programming problems, but it contains all the necessary elements. In summary, the following factors must be present if linear programming is to be applied to a problem:

1) The researcher must be trying to optimize (maximize or minimize) something

2) There must be more than one type of product, commodity, or output under consideration. In this case, the product was the composition of a broadcast day

3) There must be constraints or limitations upon the resources which must be used to produce the commodity or

product. (In the example cited, there were labor constraints, a limit on the broadcast day, and the constraint that between 1 and 2 hours must be used for commentary during a broadcast day.)

4) All constraints must be able to be described by linear equations

The current example involved only two products. But linear programming may be applied to solve for any number of products. Most linear programming problems are complicated and time-consuming; consequently, they are best solved by use of computers. The General Electric System of the Defense Intelligence School has computer programs for solving linear programming problems.

There are some optimization problems that have constraints that cannot be expressed by lines, but which should be described instead by curves. Recently, *mathematical programming* techniques have been developed to handle such problems.

More detailed explanations of the applications of linear programming may be found in *Great Ideas of Operations Research,*[21] by Jagjit Singh and *Introduction to Finite Mathematics,*[22] by John G. Kemeny and others. A more advanced source is *Linear Programming and Economic Analysis,*[23] by Robert Dorfman and others.

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[21] Jagjit Singh, *Great Ideas of Operations Research* (New York: Dover Publications, 1968), pp. 87-102.

[22] John G. Kemeny, J. Laurie Snell, and Gerald L. Thompson, *Introduction to Finite Mathematics* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1956), pp. 249-266.

[23] Robert Dorfman, Paul A. Samuelson, and Robert M. Solow, *Linear Programming and Economic Analysis* (New York: McGraw-Hill Book Company, Inc., 1958).

Regression and Correlation

The ability to identify a relationship is an important asset in solving problems, and *regression analysis* and *correlation analysis* are two invaluable techniques for studying relationships. *Regression analysis,* the first technique that will be described, enables a researcher to answer the question: How much does one variable (a phenomenon, such as a condition, a number of events, and so on) increase or decrease when another variable increases or decreases? For example, regression analysis could be used to determine how much the amount of supplies transported along a given road system would vary with increases or decreases in the amount of precipitation.

Correlation analysis (discussed earlier in Chapters XIV and XVI) enables the researcher to answer the question: How strong is the relationship between two variables? Correlation analysis, for example, would enable the researcher or analyst to determine how much confidence he could place in his estimate of the number of loads of supplies transported along a certain road network predicted on the basis of the amount of rainfall. Although regression analysis and correlation analysis often go hand in hand, they do not measure the same thing.

To illustrate the application of regression analysis and correlation analysis to a typical intelligence problem, the relationship between the monthly rate of inflation in a country and the number of acts of violence per month directed toward the government in that country will be analyzed. The data for both variables (Table XVII-2) are measures taken each month for 10 successive months. The data are recorded in chronological order, but it should be noted that the timing of a particular violent act or of a particular inflation rate does not enter into calculations. Although the timing of these variables may be important, the timing would have to be explained by another type of analysis.

Once the data had been plotted on a graph (Figure XVII-10), the analyst would draw a single line to represent the relationship between the data. He could do this several ways. The simplest way would be to take a straightedge and draw a

Table XVII-2. Number of Acts of Violence and Monthly Rates of Inflation

MONTH	MONTHLY RATE OF INFLATION (x_i)	NUMBER OF ACTS OF VIOLENCE/MONTH (y_i)	RATE X ACTS $(x_i \cdot y_i)$	RATE SQUARED $(x_i\ y_i)$	ACTS SQUARED $(y_i)2$
1	.4	2	.8	.16	4
2	1.6	6	9.6	2.56	36
3	2.4	14	33.6	5.76	196
4	1.6	17	27.2	2.56	289
5	3.2	14	44.8	10.24	196
6	3.6	26	93.6	12.96	676
7	3.2	22	70.4	10.24	484
8	4.4	29	127.6	19.36	841
9	4.0	21	84.0	16.00	441
10	1.2	7	8.4	1.44	49
	$\Sigma x_i = 25.6$ $\mu u x_i = 2.56$	$\Sigma y_i = 158$ $\mu u y_i = 15.8$	$\Sigma x_i y_i = 500$	$\Sigma x_i^2 = 81.28$	$\Sigma y_1^2 = 3212$

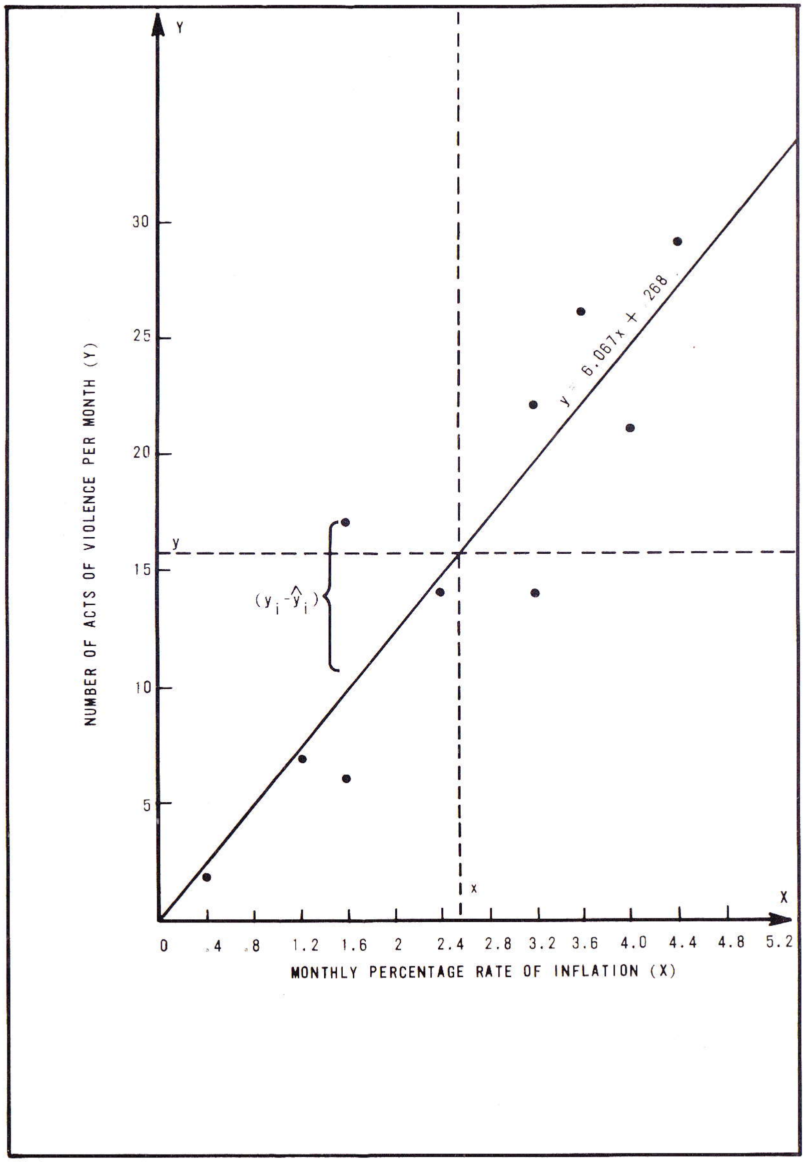

Figure XVII-10. Regression and Correlation Analysis of Acts of Violence and Monthly Rates of Inflation in Country "X"

straight line between the points so that the line would be as close as possible to each point on the graph. However, there are disadvantages with this technique: it is subjective, and unreliable. Different analysts will obtain different results using this method, and, therefore, it provides a poor foundation for further analysis of the strength of a relationship.

The most common mathematical method for drawing a regression line is called the *least-squares method.* The method is so named because it specifies the line which makes the total of the squared distances from actual y values to the line as small as possible. The actual y_i minus the predicted y ($y_i - \hat{y}_i$, Figure XVII-10) is measured parallel to the y axis.

The final form of the equation is the same as the equation of any line, namely:

$$y = ax + b \tag{1}$$

where Y is a predicted Y value, X is an actual X value, a is the slope (or rate of increase in Y divided by the rate of increase in X), and b is the intercept point (or where the line crosses the Y axis).

The equations necessary to solve for the values of a and b are:

$$\sum_{i=1}^{10} y_i = a \sum_{i=1}^{10} x_i + b \cdot n \tag{2}$$

and

$$\sum_{i=1}^{10} x_i y_i = a \sum_{i=1}^{10} x_i^2 + b \sum_{i=1}^{10} x_i \tag{3}$$

Although equations (2) and (3) may appear involved, they are easy to solve. The analyst knows all the x_i values and y_i

values, and he knows that n equals 10 (i.e., 10 months, in this example). He can compute the necessary sums and products (which appear in Table XVII-2). Therefore, (2) and (3) become two simultaneous equations containing two unknowns which can be solved by elementary algebra. Making the necessary substitutions,

$$158 = 25.6a + 10b \tag{4}$$

and

$$500 = 81.28a + 25.6b \tag{5}$$

The value for a equals 6.067. The value for b equals .268. The equation for the regression line is:

$$y = 6.067x + .268 \tag{6}$$

When the analyst has an x value, he then uses this equation to *predict* a corresponding y value. If he were told, for example, that next month's inflation rate would be about 2.8, he would compute

$$y = (6.067 \times 2.8) + .268 \tag{7}$$

$$y = 17.2556 \tag{8}$$

When the analysis uses the equation $y = ax + b$, the purpose is to predict y from a given x value. If it were desired to predict x from a given y value, the proper equation would be $x = ay + b$. The a and b values in this equation would be different from the a and b values in $y = ax + b$.

Throughout this discussion, the prediction of y values from x values has been stressed. The prediction of one variable from another is very different from saying that one variable *causes* another. Usually several analyses of the relationships among

variables would be necessary before the cause of a variable could be established.[24]

After the relationship described by the equation of a line is established, the analyst may wish to determine *how well* the line describes the set of data points. If the line contained all of the actual data points, the points are said to be correlated perfectly, and the correlation coefficient for the data would equal ±1.0. At the opposite extreme is a set of points which would appear as a fat cloud when plotted. Such a set of data points would have a correlation coefficient of 0.0. A correlation coefficient is positive if one variable increases while the other variable increases. A correlation coefficient is negative if one variable increases while the other decreases. Either correlation may be important.

The correlation coefficient is calculated using the following formula:

$$r = \frac{n\Sigma xy - \Sigma x\Sigma y}{\sqrt{[n(\Sigma x^2) - (\Sigma x)^2]\,[n(\Sigma y^2) - (\Sigma y)^2]}} \tag{9}$$

Again, equation (9) looks complicated. But it is easy to substitute the various products and sums computed earlier. For the current example,

$$r = \frac{5000 - 4044.8}{\sqrt{(157.44)(7156)}} \tag{10}$$

$$= .8999 \text{ or approximately } .90 \tag{11}$$

[24]See also the discussion of causality in Chapter XIV, "Foundations of Analysis: Some Basic Concepts."

A correlation coefficient of .90 is very high, as is indicated by the fact that none of the points is very far from the regression line (Figure XVII-10).

If the analyst wished to establish a confidence level for an estimated value of y, he must then compute the *standard error of the estimate* ($\sigma_{y \cdot x}$). Since there is a normal distribution of data points around the regression line, it can be said that 68 percent of the actual y values fall within $1\sigma_{y \cdot x}$ above or below the regression line.

The formula for the $\sigma_{y \cdot x}$ is:

$$\sigma_{y \cdot x} \quad \frac{\sqrt{\Sigma y^2 - b\Sigma y - a\Sigma xy}}{n - 2} \tag{12}$$

Therefore, in the current example:

$$\sigma_{y \cdot x} = \frac{\sqrt{3212 - 42.344 - 3033.5}}{8} \tag{13}$$

$$= \frac{\sqrt{136.156}}{8} \tag{14}$$

$$= 4.125 \tag{15}$$

If the analyst were asked to predict the likely number of acts of violence, given that next month's inflation rate would be about 2.8 percent, he would first compute equation (6) and

determine that there will be 17 acts of violence. Finally, using the $\sigma_{y \cdot x}$, he could report that there is a 68 percent likelihood that there will be

$$17.2556 - 1\sigma_{y \cdot x} = 13.1306 \tag{16}$$

$$17.2556 + 1\,\sigma_{y \cdot x} = 21.3806 \tag{17}$$

or 13 to 21 acts of violence in the next month, and a 95 percent likelihood that there will be

$$17.2556 - 1.96\,\sigma_{y \cdot x} = 9.1706 \tag{18}$$

$$17.2556 + 1.96\,\sigma_{y \cdot x} = 25.3406 \tag{19}$$

or between 9 and 25 acts of violence in the next month.

History has shown that citizen unrest is often correlated with economic instability, so the current example probably shows a meaningful correlation between sets of data. However, sometimes one discovers high values of correlation which are spurious.[25] The analyst's best defense against placing too much importance upon the value of the correlation coefficient is his own knowledge of the variables.

Although a line was fitted to the data sets in the current regression example, sometimes a curve rather than a straight line better describes a relationship. The mathematical expressions necessary to create these curves are, for the most part, much more complicated than the equations for the linear relationship.

The current example used only two variables, but regression and correlation analysis may also be completed for three or

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[25] For example, for many years the number of graduates in theology from Oxford University was nearly perfectly correlated with the number of arrests made for prostitution in an Australian city.

more variables. For example, the monthly rate of inflation, the number of acts of violence per month, and the margin of profit for large industries could all be subjected to correlation analysis.

Regression analysis and correlation analysis are described in nearly every book on statistics. Two books that might be consulted are George H. Weinberg and John A. Schumaker, *Statistics: An Intuitive Approach*[26] and William L. Hays, *Statistics*.[27]

Graphic Depictions as Aids to Analysis

The value of graphics in printed reports or as briefing aids is obvious. What may not be apparent, however, is the value that graphics may have in the *analysis* of data. Graphic depictions do more than transform numerical data or words into pictures. Very often graphic depictions reveal relationships that might not be apparent otherwise. Described below are four examples of the uses of graphics in various types of analyses.

Utility curves

One example of a graphic depiction that directly aids analysis is the utility curve. Utility curves are often used in business and industry to determine "break even" points–points where, for example, a return could be realized on an investment, or the point in time when the per-unit cost of manufacturing a certain commodity would be lowest. In mass production, the first item produced is the most expensive. As more items are produced, the per-unit cost decreases until a certain point is reached. Utility curves help the analyst to determine these points (Figure XVII-11).

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[26]George H. Weinberg and John A. Schumaker, *Statistics: An Intuitive Approach,* Second Edition (Belmont, California: Brooks/Cole Publishing Company, Inc., 1969).

[27]William L. Hays, *Statistics* (New York: Holt, Rinehart and Winston, 1963).

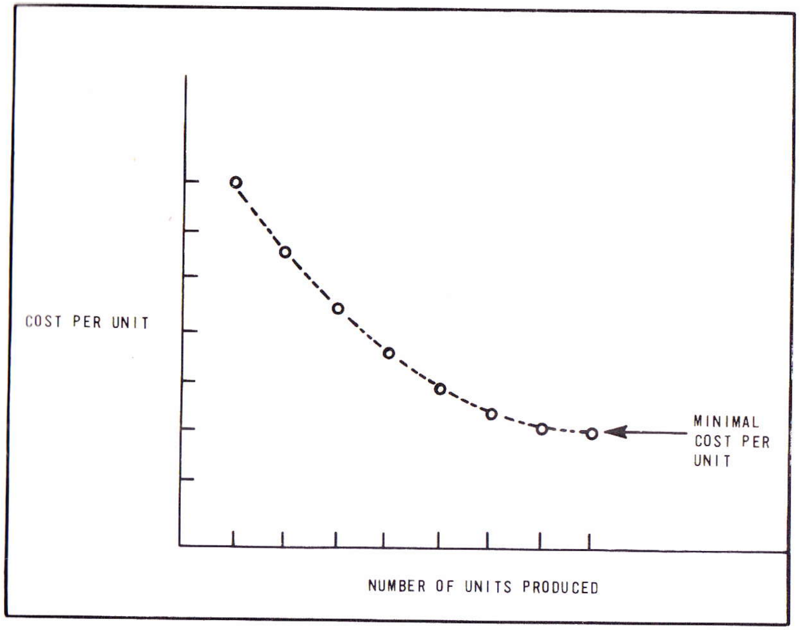

Figure XVII-11. A Utility Curve Showing the Decreasing Costs Per Unit Over Time

Utility curves might be employed in analyzing geo-political problems as well. For example, the U.S., over the years, may have been providing a fixed amount of assistance annually to a country in exchange for base privileges. It may be the case, however, that the recipient country would begin restricting privileges granted earlier. A graph such as the one shown in Figure XVII-12 would depict the value (or worth) of the privileges received for a fixed amount of dollars paid out over a number of years. The worth or value of the privileges received would have to be expressed in a unit that would permit comparisons with expenditures. In short, it might require the researcher or analyst to place a dollar figure, for example, on intangibles such as "international good will," or on the worth of a country participating in an alliance–admittedly, no easy matter in some cases.

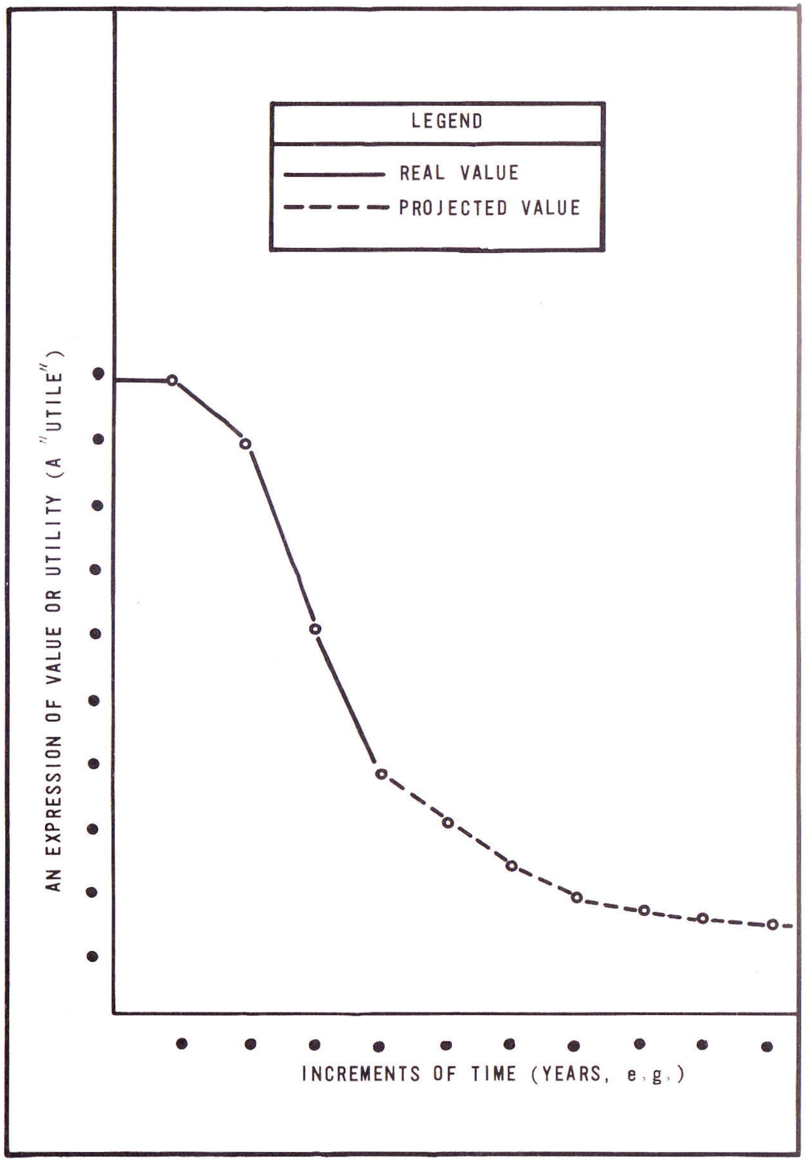

Figure XVII-12. A Graph of the Actual and Projected Worth of a U.S. Expenditure in Country "X" Over Time

The graph would indicate that the value of the privileges gained versus the funds expended fell off sharply after the second year, and that the projected return on investment was estimated to continue to decline but at a slower rate. The graphic depiction, in this case, makes the presentation of data more dramatic than, say, a column of figures. But the graph may serve another purpose as well.

If the political or military objectives of the host country were known, a similar type of curve could be plotted for that country. For example, the host country might need a certain quantity of materiel to equip a specified number of units of its armed forces. If the major source of financial aid used for the purchase of this equipment were credits or payments made by the U.S. for base privileges, then the degree to which that country was progressing toward its immediate objective could be plotted. (Figure XVII-13.)

The graph shows that the point where the two lines cross over is about the point in time where the host country's returns (returns in the form of some capability that was translated into dollars or into some other expression of utility) begin to accelerate. The crossover point might also represent a point beyond which the U.S. might no longer consider its investment to be cost effective. At the minimum, however, this crossover point would indicate a point in time when negotiations might prove most fruitful.[28]

In this example, only one "utile" value was expressed. Presumably, this single value represented a composite of many separate elements. Generally, it would be easier and perhaps more valid to plot the utilities of each component value separately rather than expressing all values as one single value.

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[28] In game theory terminology, this crossover point would be roughly analogous to a saddle point.

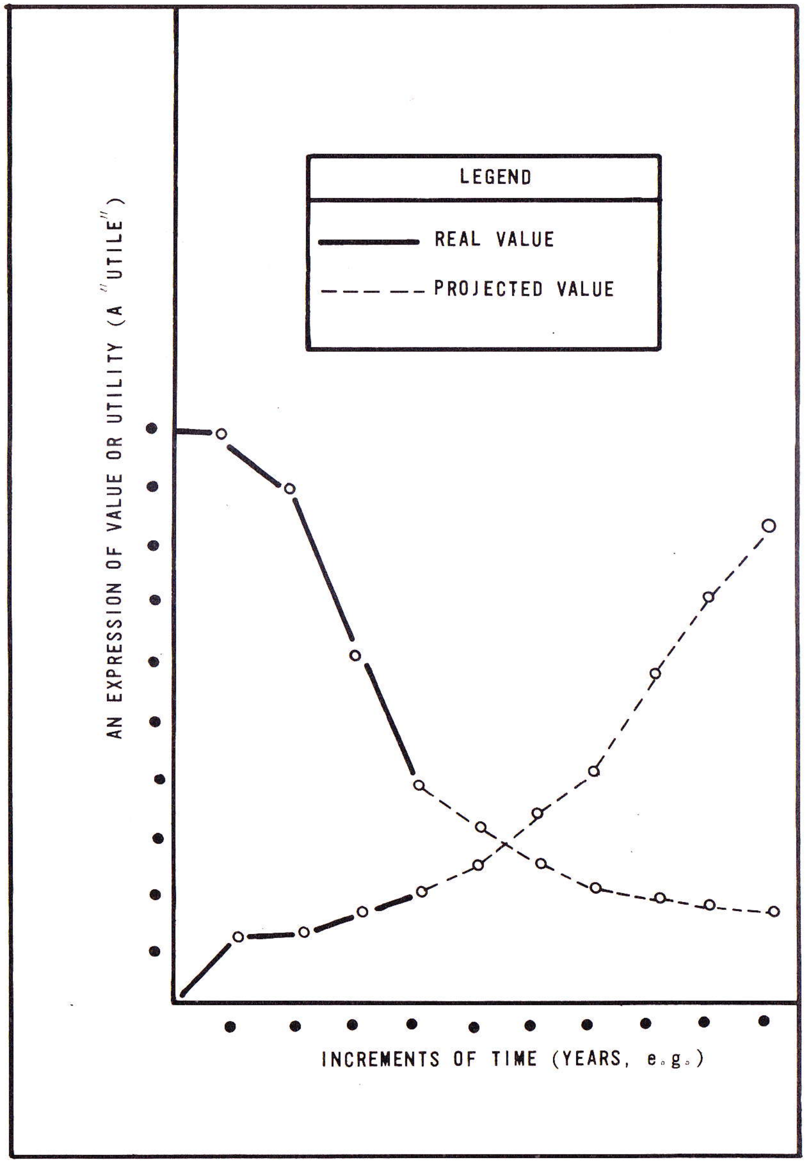

Figure XVII-13. A Graph of the Actual and Projected "Worth" of a U.S. Expenditure for Country "X" and for the U.S.

Bar graphs for comparison

As mentioned earlier, sometimes depicting data graphically reveals information that would not be too apparent otherwise. An actual example of this is shown below. The thematic output of North Korea's international and domestic broadcast facilities was tabulated over a two-week period in 1971. The tabulated data, categorized by themes, are shown in Table XVII-3. Graphing the same data, however, made readily apparent the differences in the amount of time devoted to certain themes in domestic broadcasts versus the proportion of time devoted to the same themes in international broadcasts. For example, the theme "Propagation of Ideology," constituted 34 percent of the output for international audiences, but only 14 percent for domestic audiences. On the other hand, the theme, "Present Success of Socialism," constituted 49 percent of the output for domestic audiences, but only 18 percent for the international audience (Figure XVII-14).

Terrain profiling

Terrain profiling is often used to determine areas that could not be reached by direct fire weapons. But it can be used for other purposes whenever line of sight is critical. For example, a telecommunications analyst might want to determine how many microwave relay towers would have to be constructed in order to permit microwave transmissions to and from two cities. In the example shown in Figure XVII-15, for instance, the analyst could determine that seven relay towers would be required between Ban Pak and Hua Hin. His determination would be based upon a maximum transmission range of approximately 90 kilometers between towers and a direct line of sight requirement. The exaggerated terrain profile was prepared by extending vertical lines from the most plausible route for the location of towers—the route that would utilize the highest terrain elevations and would have the minimum "masking."

Table XVII-3. **Comparison of North Korea's International and Domestic Thematic Coverage for a Two-Week Period**

THEME		INTERNATIONAL BROADCASTS		DOMESTIC BROADCASTS	
		MINUTES	PERCENT	MINUTES	PERCENT
PRAISE OF THE LEADER		35	3	45	3
PROPAGATION OF IDEOLOGY		349	34	177	14
GLORIFICATION OF THE REVOLUTION		22	2	1	1
PRESENT SUCCESS OF SOCIALISM		180	18	640	49
GUIDANCE FOR FUTURE SUCCESS		12	1	41	3
INTERNATIONAL PRESTIGE		210	20	191	15
SUPPORT FOR PEOPLE'S STRUGGLE		8	1	32	2
NEGATIVE TREATMENT:	U.S.	32	3	12	1
	ROK	136	13	140	11
	JAPAN	46	5	16	1

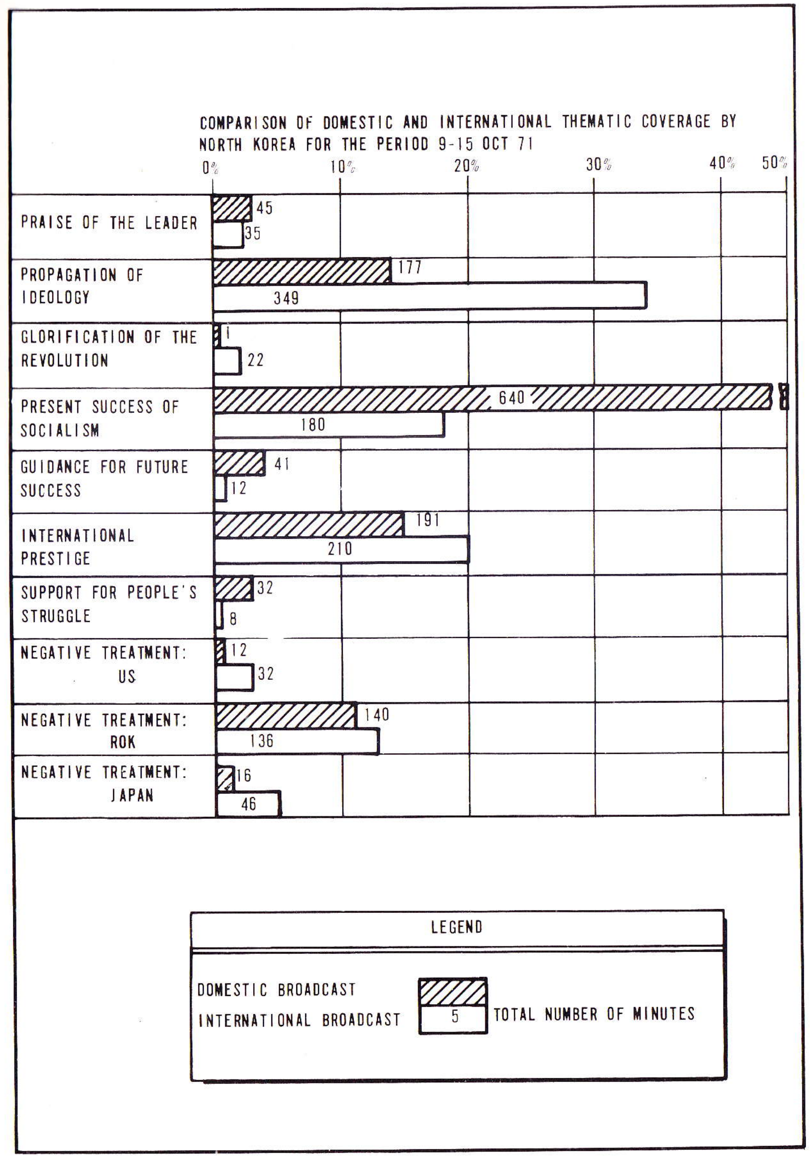

Figure XVII-14. **A Bar Graph of Thematic Coverage of North Korean Domestic and International Broadcast Facilities for a Two-Week Period**

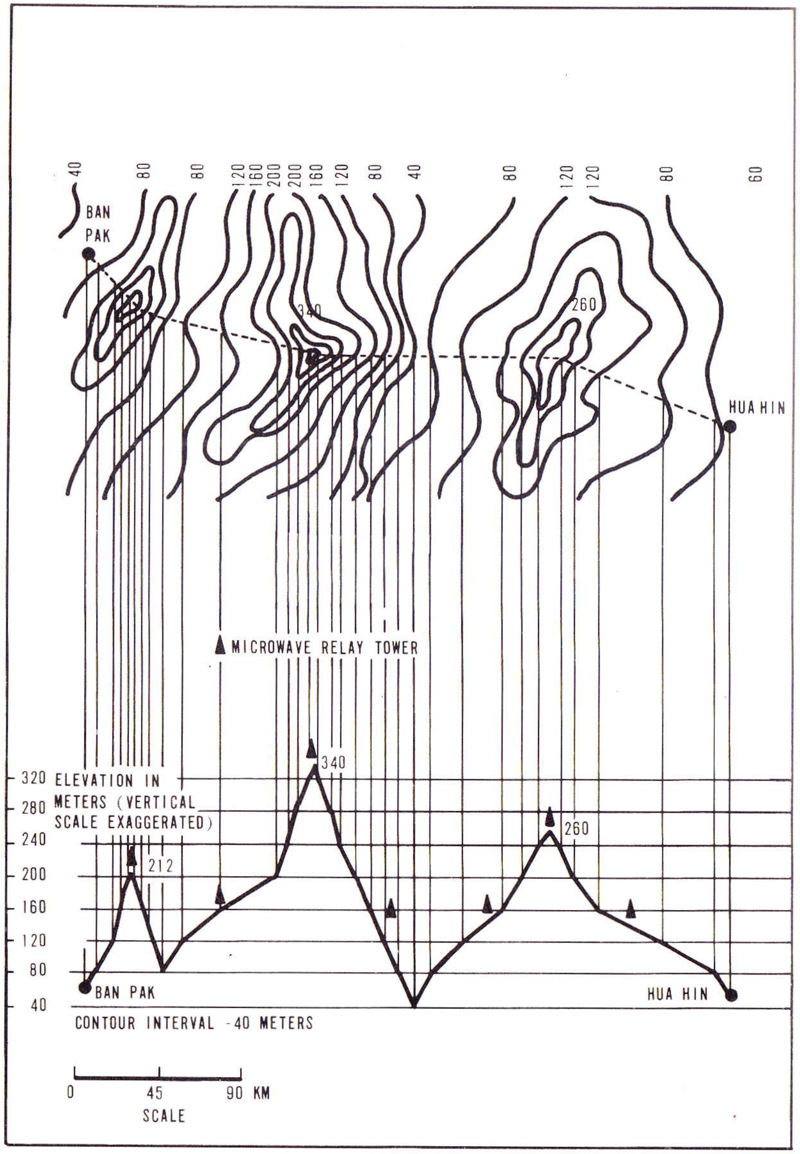

Figure XVII-15. An Example of a Terrain Profile

Trend analysis

Graphs are especially useful in trend analysis.[29] For example, the graph in Figure XVII-16 shows the number of anti-U.S. statements appearing in a foreign country's official newspaper for an eight-month period. The graph reveals peak periods in May and June and plausible reasons for these peaks would have to be established, possibly from a chronology of past events. However, the analyst or researcher might be called upon to determine if the plotted data indicated anything unusual or significant. If prior data for similar periods in the past were available, separate graphs would be overlaid (or a combined graph prepared) as shown in Figure XVII-17, and a comparison could be made directly. In the example cited, for instance, it would appear that the current "trend" represented no dramatic departure from prior "trends."

Graphs can be used to plot likely times to completion. For example, if the rate of progress had been established for constructing the rail line from Maoming (21 41 N/110 51 E) to Hsinhsing (22 42N/112 13 E), then the estimated distances to be completed within certain time periods could be graphed (Figure XVII-18). Another way of depicting progress would be to make the estimated time plots on a quasi-map graph, as shown in Figure XVII-19.

With respect to graphic depictions for analysis, an inexpensive book that an analyst or a researcher may find especially useful is Henning Nelms' *Thinking with a Pencil*.[30] For those who would be interested in graphics as presentation modes rather than analytical tools, any number of books could be used, for example, Mary Eleanor Spear's book, *Charting Statistics*.[31] For some novel, non-traditional ways of presenting

[29]See also the discussion of extrapolation, Chapter XVIII.

[30]Henning Nelms, *Thinking with a Pencil* (New York: Barnes & Noble, Inc., 1964), p. vii.

[31]Mary Eleanor Spear, *Charting Statistics* (New York: McGraw-Hill Book Company, Inc., 1952).

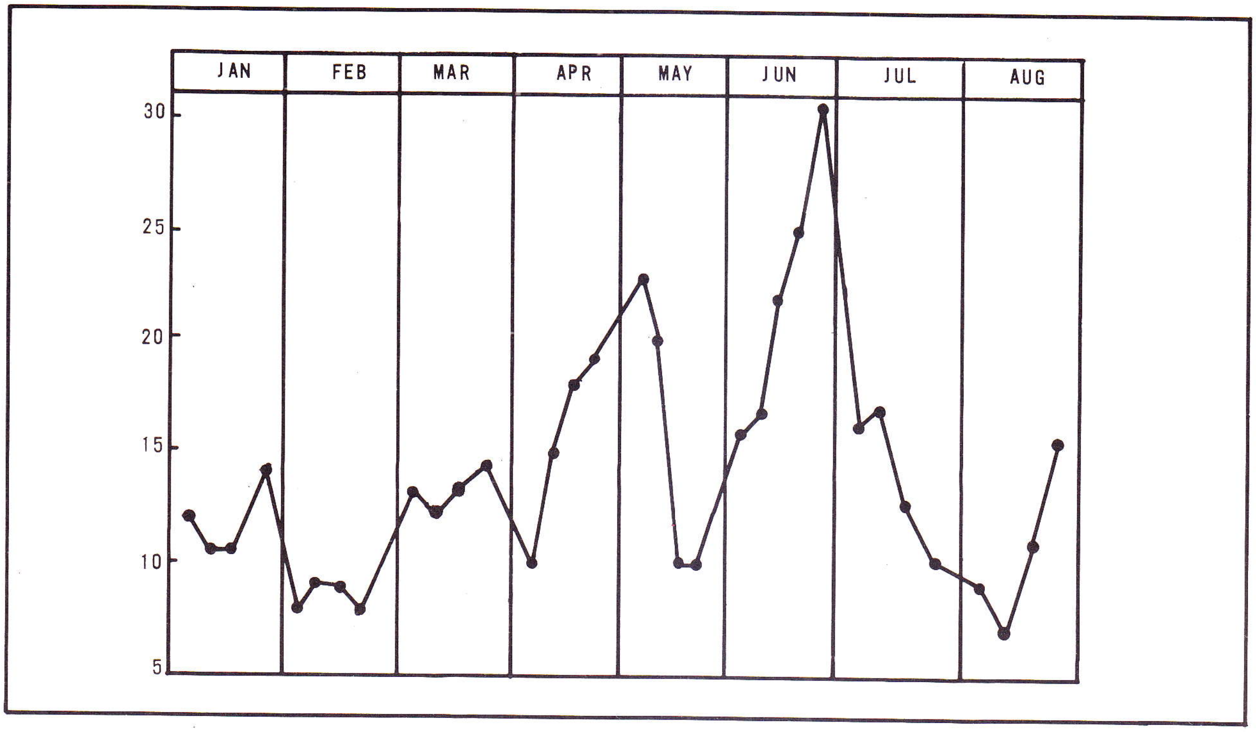

Figure XVII-16. Number of Anti-U.S. Statements Appearing in a Foreign Medium for an Eight-Month Period

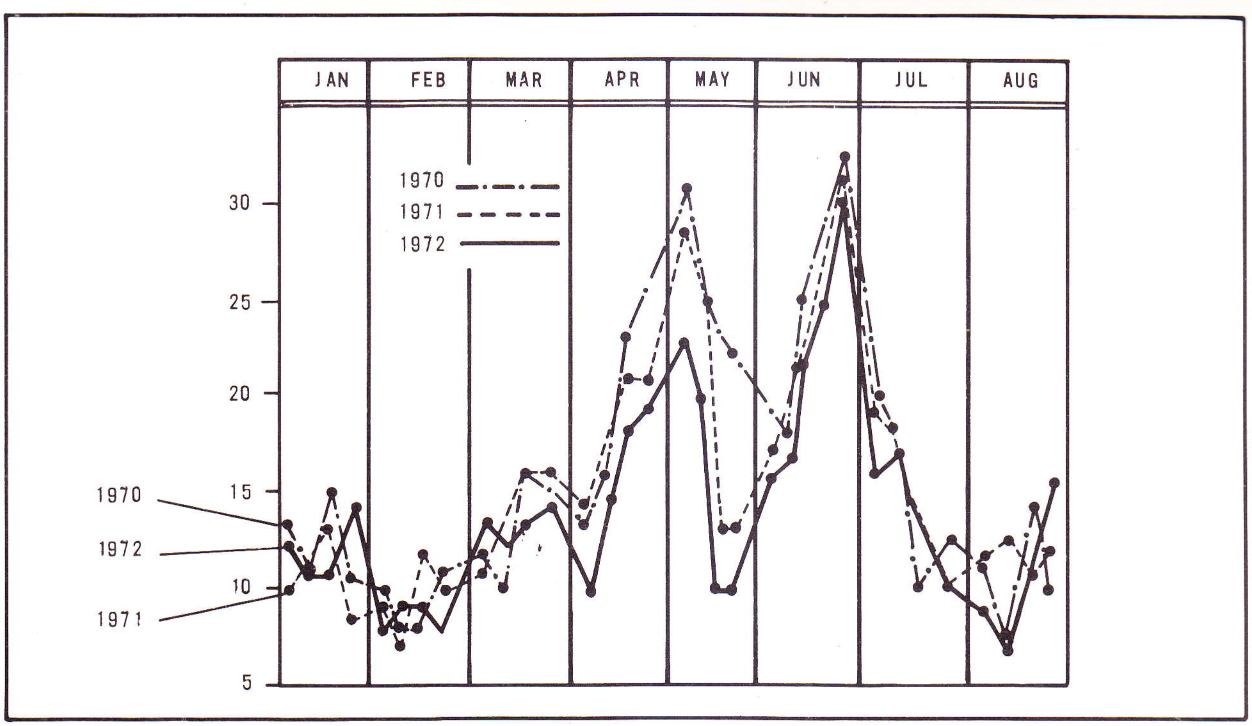

Figure XVII-17. Number of Anti-U.S. Statements Appearing in a Foreign Medium for an Eight-Month Period. (Three Years)

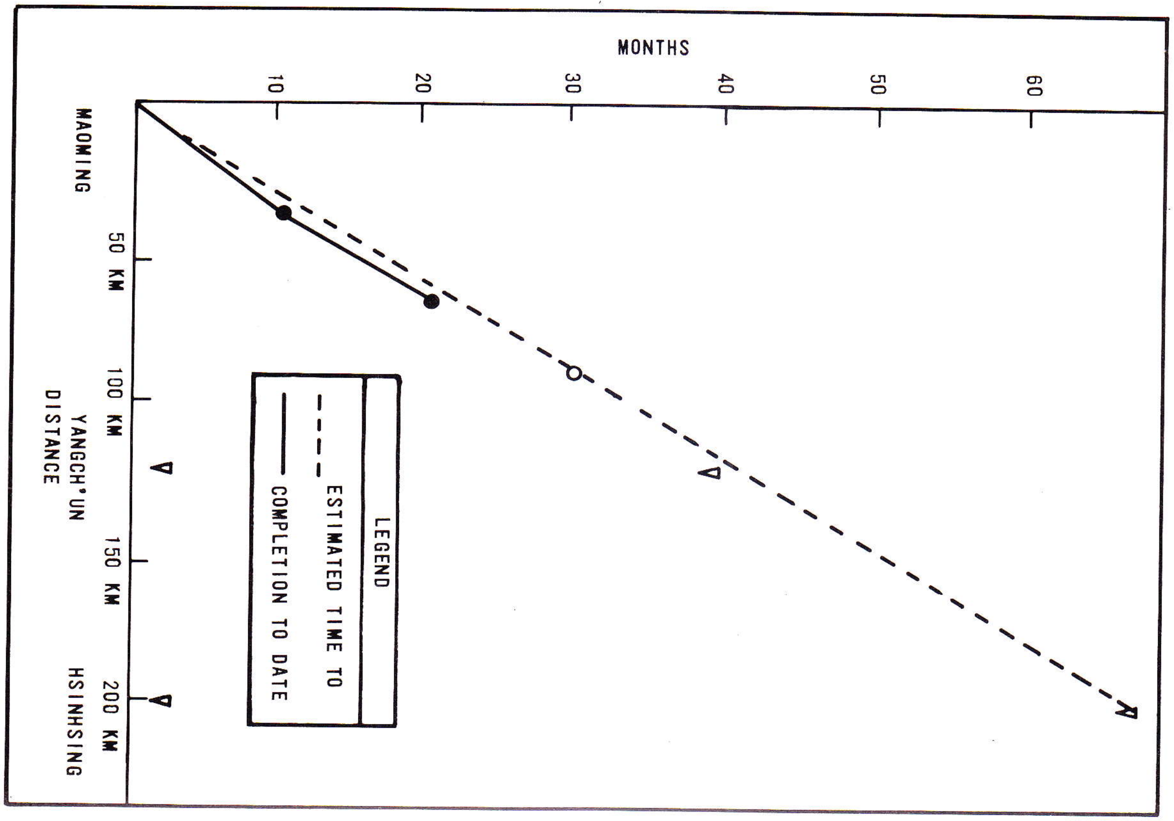

Figure XVII-18. A Graph of the Estimated Time to Complete a Rail Line

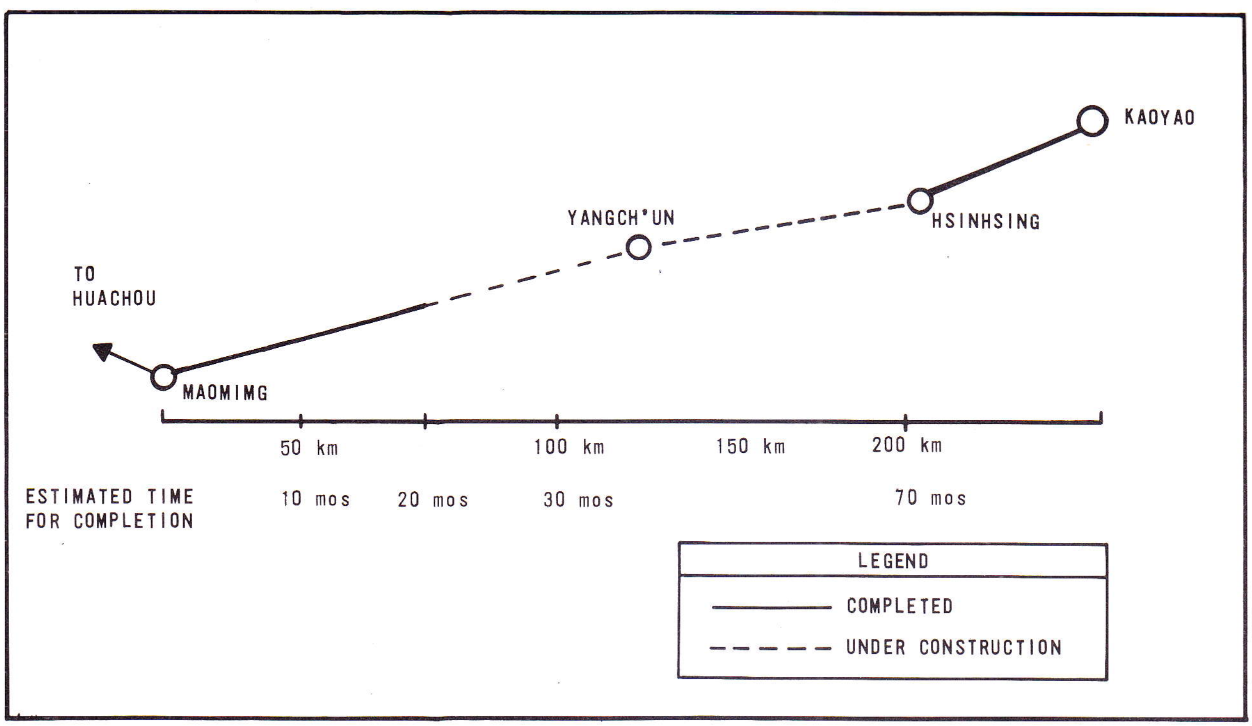

Figure XVII-19. Estimated and Real Time to Complete a Rail Line Plotted on a Map

statistical data, Roberto Bachi's *Graphical Rational Patterns: A New Approach to Graphical Presentation of Statistics*[32] should be consulted.

Summary

▷Descriptive methodologies are basic to descriptive as well as to predictive research. Very often it is necessary to describe what exists at the present time in order to be able to predict what will exist or occur in the future.

▷The construction of analogies is a basic analytical procedure used most universally in intelligence research. War games, simulations, and models are all analogies of different aspects of reality. Analogies are used as guides to reasoning in all of the components of strategic intelligence.

▷Graphic depictions are not so much specific analytical techniques as they are methods for transforming data. Consequently, they are relevant to descriptive as well as to predictive research and analysis activities.

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[32]Roberto Bachi, *Graphical Rational Patterns: A New Approach to Graphical Presentation of Statistics* (New York: Israel Universities Press, 1968).

CHAPTER XVIII
PREDICTION, FORECASTING, AND HARUSPICY

"What say the augurers?"

"They would not have you to stir forth to-day.
Plucking the entrails of an offering forth,
They could not find a heart within the beast."

Julius Ceasar, act ii, sc. ii

With the intelligence community's overriding concern for reducing uncertainty, it is not surprising that techniques for anticipating future events or conditions would have a special attraction for the intelligence researcher or analyst. This chapter discusses selected techniques for anticipating future events or conditions that have been (or can be) used in intelligence research and analysis. The first part of this chapter discusses the nature of prediction and forecasting, discusses assumptions underlying prediction, and describes the relationship of a technique to the nature of the phenomenon being considered.

Although this chapter is concerned with methodologies for forecasting, there is nothing sacrosanct about the methodology which limits its application to predicting or anticipating future events. Simulations, for example, can be used for diagnostic purposes as well as for predictive purposes. That accurate predictions have been made on the basis of "non-predictive" techniques, as such, is not only possible, but is also highly probable.

Types of Phenomena and their Relationship to Forecasting

At the outset it should be apparent that some types of phenomena are easier to forecast than others. At one end of a continuum, for example, are short-term, *unique* events which occur at specific points in time. These are the most difficult

types of phenomena to predict because they may not have any precedents. Very often, unfortunately, these are the types of events that are of most concern to the intelligence community. An example of this type of phenomenon would be an unexpected coup that toppled a government overnight, or the defection of a key scientist on a highly classified defense-related project, or a discovery of large deposits of a strategic commodity.

In the middle of the continuum are events which occur over a period of time. There may be little doubt about their outcome, but the concern may be to establish when the outcome will occur or what the effects may be. Admittedly, the point in time at which a phenomenon started may be considered a unique event, but the event is nevertheless continuous for a given period of time. An example of a continuous event would be a country's construction of its first aircraft carrier. The precise time that the carrier was started (e.g., the specific point in time when the first line was drawn on a plan) was a unique event. But, for the sake of this discussion, the time events and occurrences that would take place until the carrier completed its sea trials and became fully operational could be considered as a continuous sequence of events.

At the other end of the continuum of phenomena are cyclical events or conditions whose occurrences are just short of inevitable; for example: phases of the moon, tides, seasons, and, of course, the diurnal cycle itself.

Probabilistic Statements and their Relationship to Types of Phenomena

Predictions in intelligence are nearly always couched in some probabilistic terms. (Even this statement is translatable into probabilistic terms.) Not surprisingly, the highest probabilities of occurrence can be associated with cyclical

phenomena. Not only is the probability of a cyclical event's occurring high, but the confidence that an analyst or a researcher may have in his prediction is also high.[1]

With respect to continuous phenomena, once they have been detected, subsequent events or effects can often be predicted with a fairly high degree of accuracy. In many cases, precedents exist for continuous phenomena, and researchers can infer future events on the basis of analogous antecedents. Furthermore, by monitoring development on continuous phenomena, analysts and researchers can revise their estimates and change their probabilities.

Unique events, however, pose the most difficult problems in forecasting. And it is in the realm of forecasting unique events that the more esoteric prediction methodologies are employed. Interestingly, as will be pointed out later, these methodologies for addressing unique events are essentially techniques for employing subjective judgments of experts. However, even these more esoteric techniques deal more often with *possibilities* relating to *classes* of events rather than *probabilities* relating to a *specific, unique* event.

Assumptions—Pragmatic and Problematic

Every prediction (or predictive model) is based on assumptions. And it is usually the validity of the assumption that determines the accuracy of the prediction.[2] Perhaps one of the

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[1]As anyone who has worked with subjective probabilities can point out, the two expressions of likelihood are not the same. For every flip of a coin, the probability of tossing a "tail" remains .5 (50/50); but a gambler who has tossed ten consecutive tails may feel very strongly that the next toss will be a "head."

[2]Sometimes the assumptions are valid, but the facts are wrong. For example, the assumption that the Japanese Manchurian Army would fight tenaciously was a valid one. But for years, the Japanese Manchurian Army existed only in the minds of U.S. military planners.

most fundamental assumptions is that events which occurred in the past will occur again in the future. The causal factors for an event's occurring may not be known, but predictions based on the assumption that previous events will occur again are usually based on large numbers of observations. For example, it is not necessary to understand how or why lunar eclipses occur in order to predict that they will occur and when they will occur.

Higher on an imaginary ladder of abstraction are assumptions that the same collective factors that brought about (or caused) an event in the past will bring about a similar result in the future. The most familiar expressions of this assumption are weather forecasts. Having established and tested cause-and-effect relationships and having classified and coded all of the factors that determine meteorological conditions, meteorologists can make very accurate predictions for different time periods.[3] Predictions based on the identification of causal factors are generally highly reliable, and in laboratory situations, they are practically infallible. The identification of causal factors permits researchers to construct deterministic models—models which will unerringly predict accurate outcomes *if* the data provided to the model are correct. Again, this is relatively easy to do in laboratory situations, but very difficult to do in unstructured situations involving human behavior.

Another common assumption, and one that manifests itself especially in the behavior of investors in stocks, is that a trend that exists now will continue—at least for the immediate future. Thus, upward surges of the market are stimulated in part by their own momentum, and downward plunges are exacerbated by the expectation that the downward trend will continue. A drop in the market generates pessimism which stimulates more selling. Aside from "technical adjustments" due to profit taking, trends continue until some potentially significant event brings about a change in buyers' expectations. The assumption

[3]That the predictions are sometimes inaccurate is due to a lack of the most recent information, not to a fallacy of the predictive models.

that trends continue (or will continue for some specified period of time) is the assumption that underlies all *extrapolations*, one of the more common techniques for predicting trends.

In the realm of social behavior, assumptions are made about how the other side will behave. In fact, interpersonal relations would be impossible without minimal expectations (assumptions) of how humans would behave under certain circumstances.

Expectations of human behavior are also based on observations of past behavior, and again the prevailing assumption is that behaviors which existed in the past will persist in the future.

This assumption paid off well in the decisive battle of Tannenberg in 1914. Very briefly, Colonel General Max von Prittwitz und Graffon's Eighth German Army under Hindenburg faced two Russian armies in East Prussia whose combined forces greatly outnumbered his own. However, Lieutenant Colonel Max von Hoffman, a German staff officer, recalled that the two Russian generals, Pavel Rennenkampf and Aleksandr Samsonov, were bitter enemies. (They were seen fighting in a railway station in Mukden during the Russo-Japanese War.) On the basis of their past behavior, von Hoffman predicted that neither would make any special effort to come to the aid of the other if he were hard pressed. On the basis of this prediction, Hindenburg ordered Prittwitz und Graffon to expose his flank and to engage the Russian Second Army commanded by Samsonov. Rennenkampf, true to his predicted behavior, did little to relieve the pressure on Samsonov who was subsequently defeated. Shortly thereafter, Rennenkampf's First Army was also defeated at the Battle of the Masurian Lakes. Von

Hoffman's prediction of behavior based on past observation proved accurate.[4]

A fundamental assumption that is typically made about other humans, e.g., the "other side," is that they are rational—rational in the sense that certain acts would be perceived by *all* participants or observers as being beneficial or detrimental, either with respect to cost for benefit gained or to survival. And admittedly, assumptions of this nature are necessary starting points. But they have their weaknesses.

For example, from a rational standpoint of cost effectiveness, the procedures used by the scientists and engineers on the Manhattan Project to develop the atomic bomb were fantastically expensive. Not knowing which of two methods would work, General Leslie Groves ordered the construction of two production facilities—one using the gaseous diffusion method and the other using a centrifugal method for producing fissionable material. Both methods had only a theoretical chance of success, and both procedures were very costly. But the stakes were high, and the fear that Germany would develop fissionable material first made the risk of wasting millions of

[4]One of the more ambitious undertakings in identifying, coding, and analyzing patterns of national behavior for the purpose of predicting future behaviors of nations as they interact with other nations is the DON (Dimensionality of Nations) project. Employing factor analysis and linear algebra, the project attempts to identify major attribute patterns in terms that would permit the analysis of cross-national data. The attribute patterns include "size," "economic development," "political orientation," "density," "Catholic culture," "foreign conflict," and "domestic conflict." The project analyzed over 100 behavioral variables for about 400 two-nation combinations. The focus of the project is to identify regularities in the relationship of attributes and behavioral variables—regularities that would serve as the basis for predicting future behavior. The research was performed by the Department of Political Science and the Social Science Research Institute of the University of Hawaii under a grant provided by the National Science Foundation.

dollars an acceptable one. In light of the monumental technical difficulties that had to be overcome, and in light of the tremendous costs in time, manpower, and facilities, it is little wonder that the highly rational German scientist Werner Heisenberg refused to believe that the Americans had in fact detonated successfully three atomic devices.

Heisenberg's incredulity about American atomic capabilities reflects a host of other assumptions that prevail when behavior is anticipated. For example, Heisenberg assumed that because the highly touted German physicists could not devise methods for producing large amounts of fissionable material, neither could any other group of physicists.

For years American planners assumed that the Japanese would never surrender in battle, and, if they were captured, would refuse to cooperate with their interrogators. Both assumptions initially had a degree of face validity, but subsequently proved invalid.

Success in battle is often a function of risks, and risks are not rational in the conventional sense of the word. Assumptions are a necessary part of every predictive technique. Assumptions serve a pragmatic function in the sense that they provide a basic framework on which a predictive model can be constructed. In addition, assumptions are necessary for planners to choose an optimum course of action. As T. C. Schelling stated,

> In any analysis that leads to a choice of a particular strategy or weapon system from among several alternatives, there is typically some assumption about the behavior of the enemy. If it is not explicitly stated, it is embedded somewhere in the analysis.[5]

But in the realm of anticipating behavior, the unvalidated assumption can debase the whole predictive exercise.

[5]T. C. Schelling in E. S. Quade, *Analysis for Military Decisions* (Chicago: Rand McNally & Company, 1964), p. 199.

Delphi Techniques

The simplistic solution to the problem of predicting what will happen in the year 19—— would be to ask the experts. And decision makers have been "asking the experts" for centuries (with varying degrees of success).[6] On the assumption that the collective judgment and wisdom of several experts is better than the estimates or predictions of one, a technique for eliciting and combining judgments systematically from a group of experts has been developed. Appropriately, the technique is referred to as the *Delphi technique.*

This is how the technique is applied. A series of questions is asked of each expert. The experts submit their judgments individually. The results of all of the judgments are tabulated and these results are sent back to the experts for modification. In essence, the experts are asked to reevaluate their original estimates in light of the estimates and the rationales for the estimates submitted by other experts. The results of the second iteration are tabulated, and the new results are again sent back to the experts for revision. The process continues until a fairly high degree of consensus is reached, or until the experts would no longer modify their previous estimates.

Typically, the technique has been used in technological forecasting. But the technique could be used in any type of problem-solving situation for which there was no answer, but only varying opinion. For example, in an early study conducted by RAND, the technique was used to address issues such as predictions of scientific breakthroughs, predictions of the impact of automation, predictions on progress in space, and predictions of weapon systems of the future.

The technique can be employed in a number of different ways. For example, questionnaires can be administered

[6]Prophets, augurers, soothsayers, and haruspices provided this service in the past. Delphi technique derives from the Greek oracle who lived in Delphi.

anonymously so that one expert would not know the identities of other experts, and the results of these questionnaires could be processed manually. Another procedure would be to have the experts interact directly with each other, either in a face-to-face meeting or by use of teleconferencing techniques. Still another method would be to employ teletype devices connected to computers' memory devices. Although expensive and restrictive (in the sense that the expert must be near a terminal), this method permits the computers to perform the relatively simple statistical operations (e.g., calculating means, medians, and quartiles), to store and retrieve earlier responses, and to present new data in real time.

The major advantage of the technique is that it permits analysts to obtain an objective consensus of expert judgment. Another advantage of the technique is that it makes the rationale underlying a specific estimate or prediction explicit for everyone.

The weakness of the technique is that a truly perspicacious expert's judgment might be lost when a consensus that actually represents a *range* of judgments is produced. In face-to-face situations, for example, one expert might be swayed more by the rhetoric than by the validity of another expert's argument. But the potential for this problem exists whenever humans interact, and is not necessarily a weakness of the Delphi technique *per se.* Administering the technique remotely and anonymously is one way of reducing the impact of "rhetorical intimidation."

For additional information on the application of the technique, the following sources might be consulted:

Norman C. Dalkey, *The DELPHI Method: An Experimental Study of Group Opinion* (Santa Monica: Rand Corporation, RM-5888-PP, June 1969).

James R. Bright, ed., *Technological Forecasting for Industry and Government* (New York: Prentice Hall, 1968).

Theodore J. Gordon and Olaf Helmer, *Report on a Long-Range Forecasting Study* (Santa Monica: Rand Corporation, September 1964).

Bernice Brown, T. J. Gordon, and Olaf Helmer, *Appendix to the Report on a Long-Range Forecasting Study* (Santa Monica: Rand Corporation, September 1964).

Murray Turoff, *The Design of a Policy Delphi;* Executive Office of the President, Office of Emergency Preparedness, Technical Memorandum TM-123, February 1970.

The Delphi technique would be applicable to a range of estimative/predictive-type problems encountered in Economic, Political, Scientific and Technical, and possibly, Armed Forces Intelligence research and analysis.

Generation of Alternative Futures

Although similar to the Delphi technique, the generation of alternative futures does not require the systematic eliciting of experts' judgments until a consensus is reached. Instead, the generation of alternative futures uses the creative powers of a single person or of a group of experts working together to produce a number of scenarios.

Basically, the generation of alternative futures involves specifying certain assumptions about a people, a country, an international situation, or a technological development, and then inferring the various outcomes that might result under the stated conditions. Alternative futures are usually cast in the form of scenarios—narratives which describe conditions, behaviors, and acts of people and their impacts on a future environment.

Alternative futures are not predictions in their own right. They are simply descriptions of possibilities. Alternative futures can be ranked in terms of possible, plausible, and most likely outcomes, but they are not predictive in the sense that what is forecast must necessarily come to be.

Herman Kahn developed a number of alternative futures for the 1970's in which he attempted to describe the results of

U.S.–Soviet detente, the effects of political and military realignments on NATO, and the effects of evolving military technology. In developing his alternative futures, Kahn used game theory, systems analysis, and cost-benefit ratios to create a set of realistic, plausible futures. In a less detailed fashion, Morton H. Halperin, in his short book, *China and the Bomb,*[7] also generated a series of alternative futures pertaining to the People's Republic of China's acquisition of a nuclear capability and delivery system.

Alternative futures are often used in policy formulation. Although one cannot necessarily predict which of several "futures" will result, one can usually anticipate what the results of certain futures will be. Alternative futures, in a more limited sense, are also generated when scenarios of war games are prepared. Interestingly, one of the purposes for which a game may be played is to determine (quasi-empirically) what the implications of certain "futures" may be.

There is no single technique that comprises the methodology for generating alternative futures. In certain cases the Delphi technique has been used, and in other cases, simple, straight-line extrapolations of present conditions into the future have been used. Experts familiar with the problems being addressed can identify limiting factors and modify the straight-line extrapolations accordingly. Like every other technique which utilizes judgment, expert knowledge of the subject matter is essential if the alternative futures are to have any validity.

For examples of works which incorporate alternative futures or discuss problems involved in generating alternative futures, Herman Kahn's paper "Alternative World Futures"[8]

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[7]Morton H. Halperin, *China and the Bomb* (New York: Frederick A. Praeger Publisher, 1965).

[8]Herman Kahn, "Alternative World Futures," paper Hi-342-B IV, (New York: Hudson Institute, April, 1964).

and Alvin Toffler's *Future Shock*[9] should be examined.

Extrapolation

One of the more common methods of forecasting future conditions or trends involves projecting into the future the trends or conditions that have existed in the past and exist at the present. In its simplest form, this "extrapolation" technique involves extending a line of a graph to depict the anticipated changes in the future on the basis of the information known to date (Figure XVIII-1).

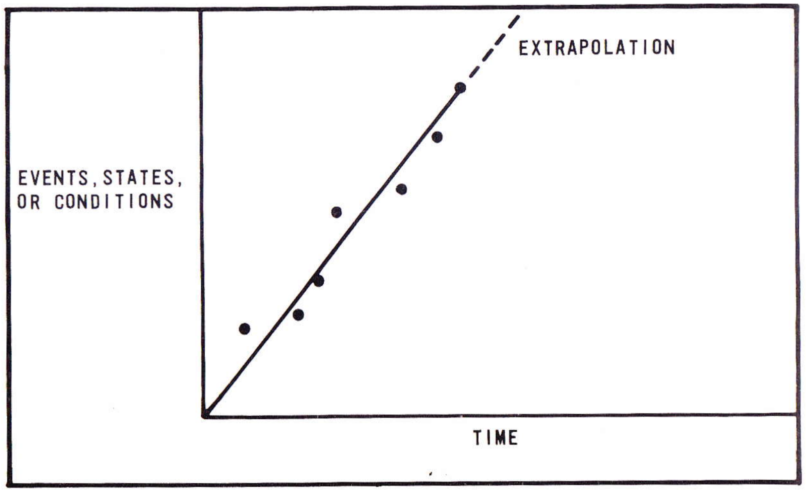

Figure XVIII-1. Simple "Straight Line" Extrapolation

In the first example of extrapolation (Figure XVIII-2), a constant number of items was added each year. In other words, N items ($y_2 - y_1$) were added during time $T(x_2 - x_1)$, and the numerical change, or N/T, was constant. The increase in many phenomena through time is constant, so the figure which describes those phenomena through time is a straight line.

[9] Alvin Toffler, *Future Shock* (New York: Random House, 1970).

Some types of phenomena are not described well by straight lines, however. Population growth is a case in point. Plotting population growth is like compounding interest. As the number of people in a population increases, so does the base which produces subsequent generations increase.

The number of people in a population which is growing by a constant *percentage* can be illustrated by an exponential curve (Figure XVIII-3). The curve can be drawn by hand, or a formula can be applied to the known data. The simplest form for the equation which describes a constant percentage growth rate is

$$y_2 = y_1(1 + r)^N$$

where y_1 equals the current population, r equals the yearly percentage increase in population, N equals the number of years between the present (x_1) and the year for which the population projection is being made (x_2), and y equals the projected population in year x_2.

When this formula is employed, r, the yearly percentage increase in population, is computed by using the known population levels in the past few years. Most of the points which represent the known population levels do *not* lie on the curve. When the formula is used, however, the projected populations for future years do lie on the curve. This characteristic is common to all extrapolation techniques. It is not uncommon for percentage rates of change to vary slightly so that a projected population may be slightly higher or lower than the actual population.

Seemingly simplistic, extrapolations based on the known dynamics of a system are not at all trivial. And although it takes little skill simply to extend a line on a graph, it does take considerable insight and judgment to know how to alter that line.

Short-range projections are relatively simple to make, and simply extending a line of a graph which represents current conditions usually suffices for predicting the immediate future.

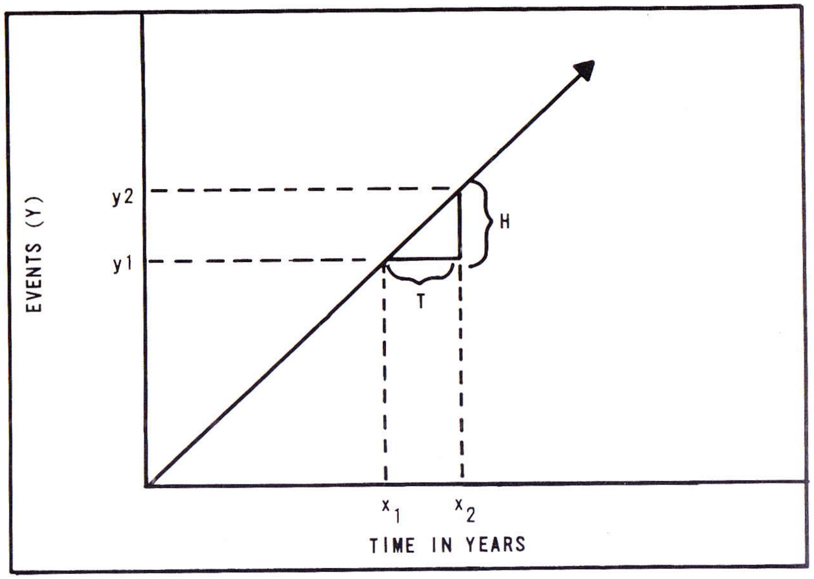

Figure XVIII-2. Extrapolation with a Constant Change

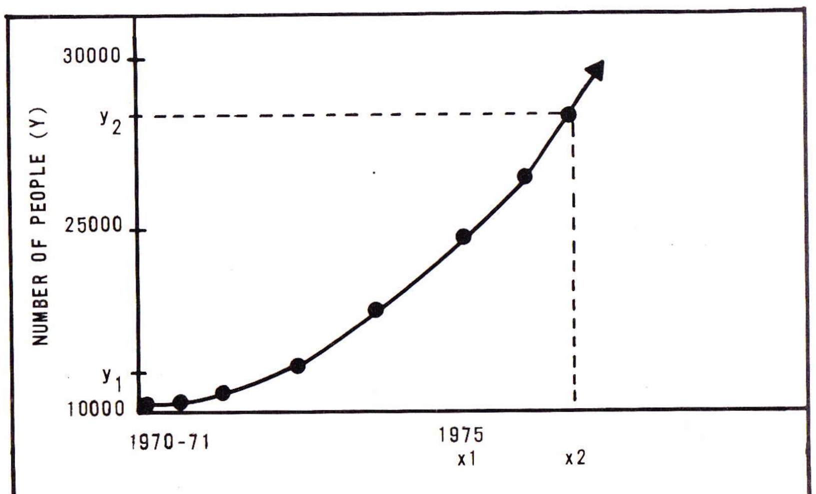

Figure XVIII-3. Extrapolation with a Constant Percentage Change

But long-range projections—the projections that are usually of greater interest to forecasters—are made up of not single continuities, but rather a series of continuities (Figure XVIII-4). The factors that affect or determine the overall series of continuities must be analyzed before a researcher is able to determine when, how much, and in what direction that extrapolated line on a graph should be bent.

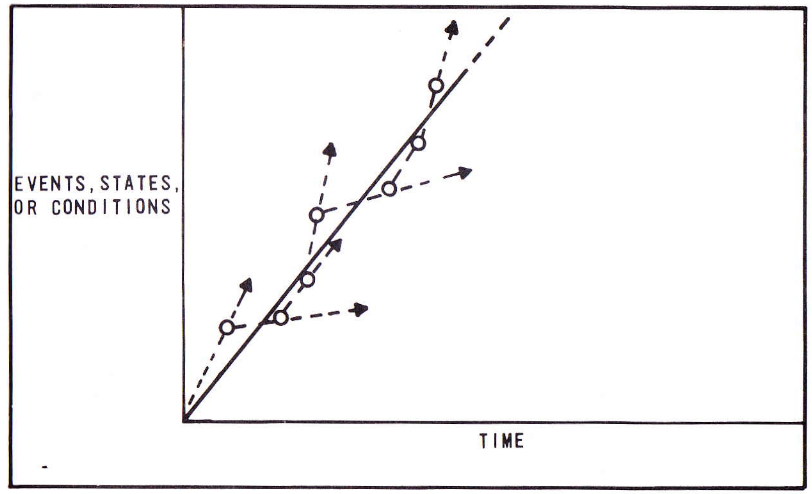

Figure XVIII-4. Long-Range Projection based on a Series of Continuities. (Lines with arrows would be short-range projections based on the immediate past and current information.)

Knowledge of plans, knowledge of the ways certain variables behave characteristically, and knowledge of special conditions provide clues in predicting trends and making projections. For example, precise knowledge of a government's budget for the current and forthcoming fiscal years provides some indications as to the extent that a current program will continue into the next fiscal year. And this information, coupled with information pertaining to the previous fiscal year, would give a

fairly strong indication of the continuity of a trend at least for a short-range period.

In other cases, certain variables may tend to behave in fairly predictable modes, and these modes provide some basis for projecting and interpreting series. For example, depletions of inventories generally herald an increase in production, and the introduction of new models usually brings about increased sales.

Knowledge of special conditions can also be used as a basis for prediction. For example, foreknowledge that interest rates will increase can be used to anticipate a decrease in new housing construction. And a major technological advance in a nuclear delivery system can be expected to bring about a new series of arms races.

Extrapolations can also be refined by knowledge of limiting conditions. For example, a country could increase its military manpower annually but only until, theoretically, every individual in that country would be in uniform. Clearly, this projection should be refined to exclude the aged, the very young, and those engaged in critical activities such as government, agriculture, and industry. One could have projected the increase in size in U.S. Naval ships, but until the World War II era, a limiting factor on the size of a naval ship was the size of the locks on the Panama Canal. Limiting factors may be physical constraints, cultural constraints, "laws of nature" (e.g., gravity, speed of light), or economic constraints.

Obviously, there are dangers to "blind" extrapolation—dangers such as concentrating on short-range trends to the exclusion of long-range trends. However, one way of minimizing the errors in extrapolation is to limit the span of future projections to the span of time for which historical data exist. Another way of minimizing error is to avoid predicting specific details. For example, in technological forecasting attempts are sometimes made to project technological developments based on an analysis of each component of a system. The assumption is that the performance limits of the components will, collectively, determine the performance limits of the system or device. Historically, however, extrapolations based on this type

of analysis have proved too conservative because major inventions ("breakthroughs") typically changed the very nature and basic configuration of the system or device.[10]

Another way of minimizing error is to express forecasts in terms of envelope curves which express the upper and lower limits of expectations and which are broad enough to accommodate normal contingencies and a normal rate of innovation (Figure XVIII-5).

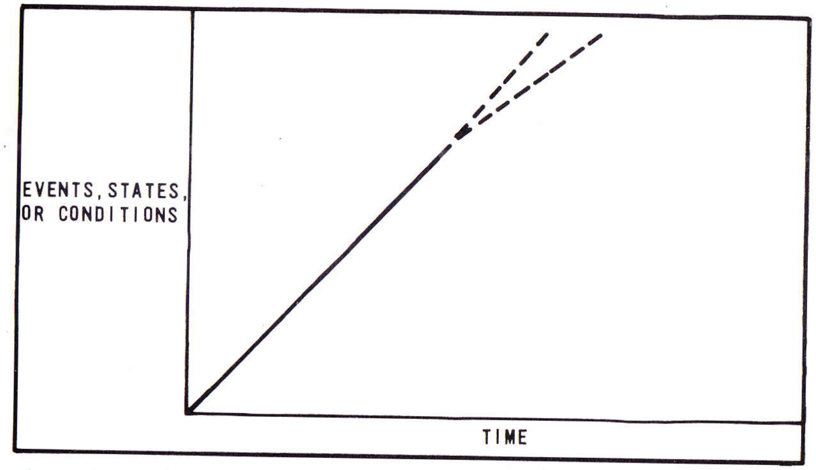

Figure XVIII-5. An Extrapolation with an "Envelope Curve" Showing the Upper and Lower Limits of Expectations

[10]The advent of the pocket electronic calculators might be cited as a case in point. Any forecaster who, forty years ago, would have projected the extent to which calculators would be in common use, probably would have made a very conservative estimate had he based the estimate on the current state of the art. Vacuum tubes, size, and weight of the electronic calculating devices of the 1940's, to say nothing of costs, made these devices impractical for general use. But the development of printed circuitry and solid state components reduced the size, weight, and costs of the devices, and increased the speed and reliability. Solid state components were not mere extensions of technology: they were revolutionary developments.

Extrapolation techniques are often discussed in works related to technological forecasting. The references suggested in the section dealing with morphological analysis (p. 325) discuss extrapolation techniques as well. Extrapolation techniques might be applied to Armed Forces Intelligence, Scientific and Technical Intelligence, Sociological and Economic Intelligence research and analysis.

Bayesian Analysis

Intelligence analysts are often asked to make a quick assessment of the likelihood of occurrence of an event. The initial assessment must often be made "off-the-cuff," on the basis of information already known about the problem. *Bayesian analysis* allows the analyst to update his probabilities systematically as new information becomes available.

For example, an analyst might be asked to assess the probability that a certain developing nation will produce a nuclear device. He formulates two hypotheses:

H_1: The nation will develop a nuclear device

H_2: The nation will not develop a nuclear device

and he assesses the prior probability that H_1 will occur as .2 and the prior probability that H_2 will occur as .8. Stated another way, the odds are .2 to .8 (or 1 to 4) that H_1 will occur.[11]

[11] Stated still another way, the analyst feels that the likelihood that a certain nation *will not* develop a nuclear device is four times greater than the likelihood that a nation will develop a nuclear device.

The analyst now seeks new information that might influence the likelihood of H_1. His analysis differs from probability diagram analysis (which will be described later) in that initially he does not try to outline all of the major conditions upon which H_1 depends. Instead, he revises the probability of H_1 every time he receives a new piece of information.

After making his initial assessment, the researcher might note that a cadre of nuclear physicists and engineers trained in the Soviet Union has returned to the country in question. The analyst decides that this fact (D) influences the probability of H_1. He is now ready to apply Bayes' theorem.

Bayes' theorem is usually expressed as:

$$P(H_1|D) = \frac{P(D|H_1)\ P(H_1)}{P(D)} \tag{1}$$

where

$P(D)$ = probability of the datum occurring

$P(H_1)$ = prior probability of hypothesis H_1

$P(D|H_1)$ = probability of the datum occurring given that the hypothesis is true

$P(H_1|D)$ - posterior, or revised, probability that the hypothesis is true given that the datum has occurred.

It is often easier for many analysts to think in terms of *odds* than in *probabilities*. The odds which assess the relative likelihood of occurrence of H_1 and H_2 may be expressed by repeating Bayes' theorem for both hypotheses:

$$P(H_1|D) = \frac{P(D|H_1)\ P(H_1)}{P(D)} \tag{2}$$

and

$$P(H_2 | D) = \frac{P(D | H_2)\, P(H_2)}{P(D)} \qquad (3)$$

When equation (2) is divided by equation (3), the P(D)'s cancel out and the following remains:

$$\frac{P(H_1 | D)}{P(H_2 | D)} = \frac{P(D | H_1)}{P(D | H_2)} \; \frac{P(H_1)}{P(H_2)} \qquad (4)$$

or, using the most common verbal definitions,

$$\text{Posterior Odds} = \text{Likelihood Ratio} \times \text{Prior Odds} \qquad (5)$$

Equation (4) can now be used to revise the prior odds to posterior odds as a function of the information in the observed datum. To go from prior odds to posterior odds one must assume first that H_1 is true and then assume that H_2 is true. The analyst than asks himself how likely it is that the datum would be observed under each assumption. If $P(D | H_1)$ is greater than $P(D | H_2)$, the posterior odds are greater than the prior odds. If $P(D | H_2)$ is greater than $P(D | H_1)$, the prior odds are greater than the posterior odds.[12]

In the example of the nation which may or may not be developing a nuclear device, $P(H_1)$ was already assessed as .2. The analyst estimates that it is three times more likely that a large number of people would be educated in nuclear physics and related fields if the nation *were* proceeding toward a nuclear capability than if the nation *were not* working toward such a capability. The equation to compute posterior odds for this example is:

[12]This discussion is based on C. R. Peterson *et al.*, "Inference from Evidence: Bayes' Theorem," *Handbook for Decision Analysis* (Washington, D.C.: Defense Intelligence School, 1973).

$$\frac{P(H_1 | D)}{P(H_2 | D)} = \frac{3 \times .20}{1 \times .80} = \frac{.60}{.80} = \frac{1.00}{1.33} \qquad (6)$$

Therefore, the odds concerning the nation's progress toward a nuclear capability have increased from 1:4 to 1:1.33.

The analyst assigns a 2:1 likelihood ratio in favor of the purchase of fuel if H_1, nuclear device development, is true. Using the posterior odds computed in (6) as the new prior odds, he calculates:

$$\frac{P(H_1 | D)}{P(H_2 | D)} = \frac{2 \times 1.00}{1 \times 1.33} = \frac{2.00}{1.33} = \frac{1.50}{1.00} \qquad (7)$$

For the first time during the current analysis, the odds have increased so that they are greater than 50:50. It now seems that it is more likely than not that the nation will develop or is developing a nuclear device.

This procedure could continue indefinitely. The analysis could be used by the researcher as a method to monitor a situation. It could also be used to determine when to begin to make policies relating to a situation. In the current example, it might be decided to try to seek information more directly once the odds were 5:1 in favor of H_1.

Bayesian analysis may be extended to a many-valued case when more than two hypotheses are under consideration. The following formulas address the many-valued case:

$$P(Hi | D) = \frac{P(D | H_i) P(H_i)}{P(D)} \qquad (8)$$

where H_i is each possible hypothesis. All the $P(H_i)$ must sum to one.

In the two-valued case, the initial formula was converted to equation (4) so that the analysis could proceed by the assessment of odds rather than probabilities. In a many-valued case it is more difficult to keep track of all the likelihood ratios. Although the basic mathematical operations are the same, the short cut for assessing posterior odds appears different in the many-valued case.

The analyst begins by listing all prior hypotheses and associated probabilities (Table XVIII-1, columns 1 and 2). Next, he assigns likelihoods to $P(D|H_i)$, (Table XVIII-1, column 3). He multiplies column 1 values by column 2 values which gives him the numerator of equation (8), or $P(D|H_i)P(H_i)$. Since the sum of all posterior probabilities must be 1,

$$\sum_{i=1}^{n} P(H_i|D) = 1 = \frac{\sum_{i=1}^{n} P(H_i)P(D|H_i)}{P(D)} \qquad (9)$$

or

$$P(D) = \sum_{i=1}^{n} P(H_i)P(D|H_i). \qquad (10)$$

Therefore, column (4) is summed to obtain P(D). Finally, each $P(H_i)P(D|H_i)$ is divided by P(D) to obtain $P(H_i|D)$, (column 5).

Bayesian analysis is appropriate for assessing the probability of occurrence of an event that might be influenced by many other events. The intermediate events should be used as data (D) when it seems more helpful to apply Bayes' theorem than to assess probabilities directly.

For more information on the application of Bayes' theorem, the following works should be consulted: Ward Edwards' introductory comments to the March 1966 edition of *IEEE*

Table XVIII-1. A Three-Valued Bayesian Analysis

(1) HYPOTHESIS H_i	(2) PRIOR PROBABILITY $P(H_i)$	(3) LIKELIHOOD $P(D\|H_i)$	(4) JOINT PROBABILITY $P(H_i)P(D\|H_i)$	(5) POSTERIOR PROBABILITY $P(H_i\|D)$
NUCLEAR CLUB	.2	.9	.18	.29
POWER PLANTS	.5	.7	.35	.56
NO NUCLEAR INTEREST	.3	.3	.09	.15
	1.00		P(D)=.62 MARGINAL	1.00

Transactions on Human Factors in Electronics[13]. Also the article by L. D. Phillips *et al*[14] in the same issue should be of interest to researchers considering applications of Bayes' theorem. Edwards, it should be noted, conducted research in the application of Bayes' theorem to intelligence problems. For the more serious student of the methodology, *Bayesian Statistics* by Donald L. Meyer and Raymond O. Collier, Jr. would be appropriate.[15]

[13]Ward Edwards, introductory comments in *IEEE Transactions on Human Factors in Electronics,* HFE-7, (March 1966): 3.

[14]L. D. Phillips, W. L. Hays, and Ward Edwards,"Conservatism in Complex Porbabilistic Inference, "*IEEE Transactions on Human Factors in Electronics,* HFE-7, (March 1966): 7-18.

[15]Donald L. Meyer and Raymond O. Collier, Jr., *Bayesian Statistics* (Itasca, Illinois: F. E. Peacock Publishers, Inc., 1970).

Probability Diagrams

Probability diagrams are tools for assessing the likelihood of occurrence of events which depend upon a large number of conditions. A probability diagram allows one to separate a problem into its component parts. The construction of such a diagram is explained here by use of an example problem: the concern of U.S. policy makers about the possible withdrawal of Country P from a military alliance.

If an analysis is to be complete, all possible outcomes of the event must be included. For example, if the event of interest is the status of Country P's membership in a military alliance, the possible outcomes include:

P remains in alliance.

P drops out of alliance.

The detailed outcomes need not be made explicit, although all outcomes are accounted for. "P drops out of alliance" can include P dropping out of all its alliances, dropping out of one and joining another and so on. "P drops out of alliance" accounts for all of these outcomes.

When one particular outcome is of special interest, such as "P remains in alliance," it is convenient to account for all other outcomes by using the negative of that statement. This simplifies the analysis by requiring only *two* choices at each branch. However, there are many instances when more choices at each level are appropriate. Diagrams of various choice combinations relating to the roll of a die, for example, are shown in Figure XVIII-6.

Outcomes must be mutually exclusive (non-overlapping). For example, "P remains in alliance" and "P remains in alliance but files a formal protest" overlap, so both may not be included in the diagram as final outcomes.

According to probability theory, if all mutually exclusive outcomes are included, the addition of their probabilities must equal 1. Therefore, at any one level of branching in a

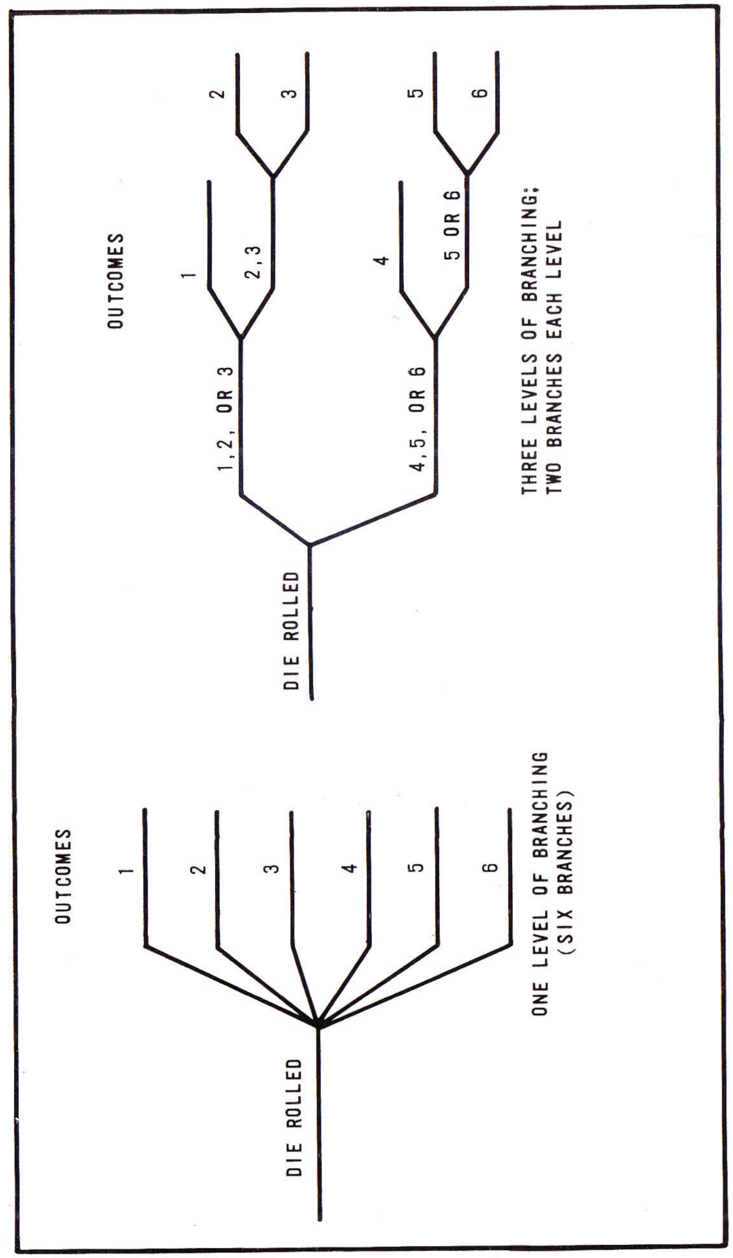

Figure XVIII-6. Different Branching Diagrams of the Same Phenomenon

probability diagram, the fractional probabilities of two mutually exclusive branches must sum to 1.

An expert estimates the probability of Country P dropping out of the alliance as .7 *before* he begins an in-depth analysis. He is not basing this probability on any assumptions or branches in the probability diagram, so it is an *unconditional* probability estimate.

On the other hand, when the expert begins to study the problem in depth, he decides that the outcome of a future election for national assemblies is the major *condition* upon which Country P's alliance status would depend. Similarly, the outcome of the election depends upon the value of Country P's currency, and the value of the currency depends upon whether or not Country P experiences a trade deficit this year. Once the analyst identifies all the major conditions upon which the status of Country P's military alliance depends, he can build a probability diagram (Figure XVIII-7). It is critical that the analyst diagram the events in the proper order. For example, if the value of currency *depends* upon the balance of trade, the value of currency must branch from the outcomes of the balance of trade, not the other way around.

Numerical probabilities are assigned to each branch, beginning with the first level of branching (trade deficit or no trade deficit, in this case). The trade deficit and no trade deficit probabilities must sum to 1.0. The expert decides, based on all his past experience, to assign a .7 probability to trade deficit, and a .3 probability to no trade deficit. In order to assess probabilities at the next level of branching, it is *assumed*, for the time being, that a given outcome has occurred. Given that a trade deficit has occurred, either there will be a devaluation of currency or there will not be a devaluation of currency.

A *path probability* can be traced for each unique set of conditions and outcomes. In the alliance example, a path probability is traced for the uppermost branches (Figure XVIII-8). The *conditional* probability that P will remain in the alliance given a Communist majority in the national assembly,

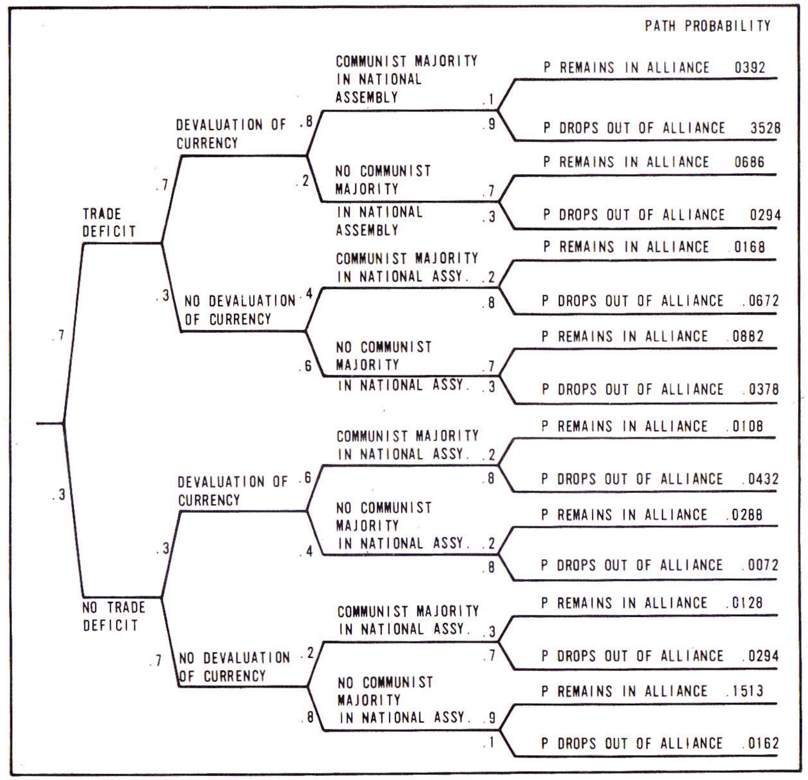

Figure XVIII-7. A Probability Branching Tree

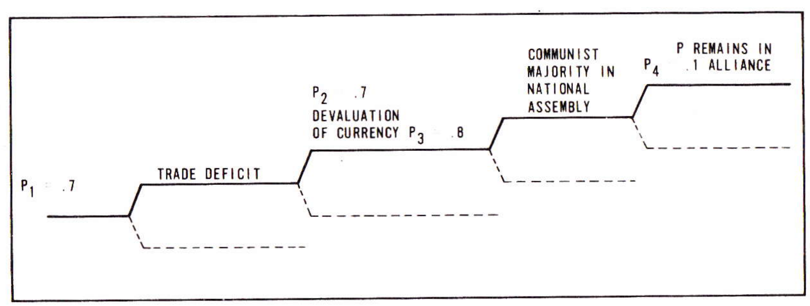

Figure XVIII-8. Probabilities Assigned to Branches

devaluation of currency, and a trade deficit is obtained by *multiplying* all the individual probabilities of these branches.

$$P_1 \times P_2 \times P_3 \times P_4 = .7 \times .7 \times .8 \times .1 = .0392$$

At the last level of branching, all of the outcomes based on all paths sum to one.

One of the more important outcomes of the example problem would be to determine the total probability of P dropping out of the alliance *regardless* of the conditions causing this outcome. *Addition* of all path probabilities for the given final outcome solves such a problem. In the example (Figure XVIII-7), .3528 + .0294 + .0672 + .0378 + .0432 + .0072 + .0294 + .0168 = .5838.

The expert can now compare the computed probability of about .6 with his estimated probability of about .7, and he may decide to revise his estimate on this basis.

Sensitivity analysis allows a person to assign a *range* of probabilities rather than a single probability to a condition. Final outcomes are computed based on the upper and lower limits of the range, and the effect of the range on the final outcome may be determined. Sensitivity analysis can indicate conditions which should be studied at greater depth.

Probability diagrams are tools for identifying the conditions which lead to certain outcomes. But it must be remembered that the assigned probabilities are subjective and are usually based upon the opinions of a few people. The final results of a probability diagram analysis should be considered only as approximations, and the values should be rounded off.

Probability diagrams, and their application to intelligence problems are discussed in detail in C. R. Peterson et al., *Handbook for Decision Analysis*, cited earlier.

Psycho-Historical, Psycho-Linguistic Analysis

Behavior patterns as manifested in speech (oral or written) have been used for purposes of analysis (description) and prediction. The predictions are based on established associations between the words and deeds of a principal actor, a head of state for example. In World War II, British propaganda analysts established that German propagandists, particularly Joseph Goebbels, would not boast of capabilities which Germany did not have because the expectations of the German population would soar and then plunge precipitously when anticipated results did not come about. Conversely, when the German propaganda machine did begin to allude to new terror weapons, the analysts inferred correctly that a new weapon was nearing operational status. (The weapons were the V-1 and V-2 rockets.)

Numerous other studies have attempted to correlate threatening statements of leaders with subsequent activities that their countries carried out. More conventional attempts to establish these associations have usually involved interdisciplinary teams—teams composed of, say, political scientists, historians, sociologists, and anthropologists. In recent years, psychologists and psychoanalysts have also participated in these types of analyses. Embracing in part sociology and anthropology, psychoanalytic theory attempts to establish the psychological as well as the cultural determinants of a principal actor's behavior. Linguistics, a branch of anthropology, attempts to define the role that language plays in determining a member of a certain culture's perception of the world and consequently, his behavior patterns.

In intelligence, for the greater part, psycho-linguistic analyses would address contemporary figures. But psycho-linguistic analysis (or psycho-historical analysis) has been performed on historical figures as well. For example, Jean Leclerq, presently Abbaye of Clervaux, made a psycho-linguistic analysis of the writings of William of Saint-Thierry, a twelfth century abbot. William's writings were compared to writings of his contemporaries, his accounts of events were compared to other historical

and economic data, and the consistency of his perceptions throughout his writings was analyzed. On the basis of this analysis, a psycho-analytic "profile" was made which revealed, for example, that William tended to project pessimism to the subjects he wrote about, notably, St. Bernard.

Similar types of analyses have been performed on public pronouncements by contemporary heads of state, and tentative hypotheses pertaining to the relationship between words and deeds have been established. Given a notably vociferous head of state, Fidel Castro, for example, numerous opportunities for testing the hypotheses may exist.

Psycho-linguistic (as well as many psychoanalytic) analyses may be very tenous. For example, the analysts are usually addressing figures of a culture different from theirs. As anyone who has done any cross-cultural analysis knows, interpretation of behavior such as speech, which carries connotative as well as denotative meaning, is subject to numerous failings and error. In many cases the validity of the basic psychoanalytic theory itself is in question.

Psycho-linguistic, and psycho-historical analyses are not without their detractors. Kenneth M. Colby, a psychoanalyst himself, says:

> Psychoanalytic studies of Moses, Leonardo, Poe, and Shakespeare are fascinating and entertaining. But they are not science; they belong to art, literature, or history . . . . Science is interested in useful generalizations about a class. An individual biography may illustrate some generalizations arrived at through other evidence . . . . These ideographic, rather than nomothetic, efforts may result in literature, but not in science.

> When art and science accost the same questions they have quite different criteria for acceptable answers.[16]

Although almost any careful researcher can establish relationships between words and deeds (if they exist), attempting to postulate reasons for the behavior (interpret behavior) requires highly specialized knowledge and skill. As such, psychoanalytic techniques are better left to the experts.

Psycho-linguistic analyses would be appropriate for Political Intelligence research and analysis, as well as for Sociological and Biographic Intelligence. Examples of intelligence analyses based upon associations between public announcements and subsequent acts are described in Alexander L. George's *Propaganda Analysis*.[17]

Morphological Analysis

Morphological analysis is a technique that was originally devised for technological forecasting. Since its introduction in the 1940's, the technique has been applied to exploratory studies of future geo-political environments and situations as well.

At its most general level, morphological analysis is a method of multi-dimensional classification.[18] Fritz Zwicky, the astrophysicist and engineer who pioneered the use of morphological analysis, classified the totality of all jet engines operating in a

[16]Kenneth Mark Colby, *An Introduction to Psychoanalytic Research* (New York: Basic Books, Inc., 1960), p. 74. That different types of research (description and prediction, for example) have different criteria for acceptance was a point stressed in Chapter VII, "Types of Inquiry and the Nature of Proof."

[17]Alexander L. George, *Propaganda Analysis: A Study of Inferences Made from Nazi Propaganda* (Evanston, Illinois: Row Peterson and Company, 1959).

[18]From Robert U. Ayres, *Technological Forecasting and Long-Range Planning* (New York: McGraw-Hill Book Company, 1969), p. 73.

Table XVIII-2. Zwicky's Classification of Jet Engines[19]

$P_1$1,2	INTRINSIC OR EXTRINSIC CHEMICALLY ACTIVE MASS	(2)
$P_2$1,2	INTERNAL OR EXTERNAL THRUST GENERATION	(2)
$P_3$1,2,3	INTRINSIC, EXTRINSIC, OR ZERO THRUST AUGMENTATION	(3)
$P_4$1,2	INTERNAL OR EXTERNAL THRUST AUGMENTATION	(2)
$P_5$1,2	POSITIVE OR NEGATIVE JET	(2)
$P_6$1,...,4	POSSIBLE THERMAL CYCLES (ADIABATIC, ISOTHERMAL, ETC.)	(4)
$P_7$1,...,4	MEDIUM (VACUUM, AIR, WATER, EARTH)	(4)
$P_8$1,...,4	MOTION (TRANSLATORY, ROTATORY, OSCILLATORY, NONE)	(4)

[19]*Ibid.* The canons of classification discussed in Chapter XV are most relevant to morphological analysis.

pure medium (e.g., vacuum, air, water, earth), which contained only simple elements and which were activated by chemical energy. His classification looked like Table XVIII-2. (The number of variations of each class is shown in parenthesis.)

Excepting the instances in which certain classes were self-contradictory (e.g., internal or external thrust generation would not apply in conditions of zero thrust augmentation), 25,344 possible jet engine combinations were generated. By examining various combinations, Zwicky was able to propose radically new inventions–inventions which were later developed successfully.[20]

Zwicky states four rules for performing morphological analysis:

1) The problem to be addressed must be stated with great precision. (This is a fundamental rule for all types of analyses or problem-solving activities, including intelligence research.)

2) The parameters or characteristics of that which is being analyzed must be identified. (This identification should be complete–a requirement that is more easily stated than accomplished.)

3) Each parameter or characteristic must be subdivided into specific cases or "states" sometimes called extensional characteristics. (This step may be difficult to perform when continuous phenomena are involved. For example, in classifying objects on the basis of speed, the division between supersonic and hypersonic is a tenuous one.)

4) The implications of the various combinations of extensional characteristics must be analyzed for possibility, plausibility, feasibility, practicality, and so on, depending upon the nature of the phenomenon analyzed, e.g., a technological process, a device, or a military or political condition.

[20]This incident is similar to the one in which Dmitri Mendeleev predicted the properties of elements which had not yet been discovered (Chapter XV). The procedures involved in constructing the periodic table were nearly identical to the procedures of morphological analysis.

In the example below (Table XVIII-3), researchers were concerned about possible new technological developments of missiles. On the basis of combinations of extensional and intensional characteristics of missiles which exist today, a matrix showing actual and possible combinations of missile characteristics could be generated.

In a morphological analysis of possible future conflicts, the intensional and extensional parameters might look like Table XVIII-4. Matrices of the type shown here have been used to generate conflict situations for gaming exercises.

Morphological analysis shows only the possibilities that may result given the combination of various elements: it says nothing about the likelihood that certain combinations would ever be realized. Despite this, the technique is a useful one for examining possibilities or for suggesting alternatives to what exists at the present time. The potential value of the output of the matrices is a function of the quality of the extensional and intensional analysis. Again, the thoroughness and creativity of the researchers play a critical role.

For more information on morphological analysis, the following works are useful: *Morphology of Propulsive Power,* (Pasadena, California: Society for Morphological Research, 1962); Robert U. Ayres, *Technological Forecasting and Long-Range Planning,* referred to earlier; and Hans Blohm and Karl Steinbuch, *Technological Forecasting in Practice* (Lexington, Massachusetts: D. C. Heath & Co., 1973). Additional materials on long-range forecasting can be found in *Long Range Forecasting and Planning* (U.S. Air Force Office of Aerospace Research Symposium, August 1966).

Morphological analysis would be an appropriate methodology for Scientific and Technical Intelligence, and, to a lesser degree, to Economic, and Political Intelligence research and analysis.

Table XVIII-3. Intensional and Extensional Characteristics of Missiles

INTENSIONAL CHARACTERISTICS	EXTENSIONAL CHARACTERISTICS
$P_1^{1,2}$ ENERGY SOURCE	LIQUID PROPELLANT - SOLID PROPELLANT
$P_2^{1,2,3,4}$ SPEED	SUBSONIC - SONIC - SUPERSONIC - HYPERSONIC
$P_3^{1,2,3}$ RANGE	SHORT RANGE - MEDIUM RANGE - LONG RANGE
$P_4^{1,2,3,4}$ GUIDANCE	COMMAND GUIDANCE - DEAD RECKONING - POSITION FIXING-HOMING
$P_5^{1,2}$ WARHEAD	SINGLE - MULTIPLE

Table XVIII-4. Intensional and Extensional Parameters of a Conflict Situation (After Ayres)[21]

INTENSIONAL CHARACTERISTIC		EXTENSIONAL CHARACTERISTIC
$P_1{}^{1,2,\ldots,n_1}$	REGIONS	EUROPE, MIDDLE EAST, ETC.
$P_2{}^{1,2,\ldots,n_2}$	LEVEL OF CONFLICT	SUBCRISIS MANEUVERS, INTENSE CRISIS, INSURGENCY WAR, NUCLEAR WAR, ETC.
$P_3{}^{1,2,\ldots,n_3}$	REASON FOR UNITED STATES INVOLVEMENT	TREATY PARTNER OF ONE BOTH SIDES, TRADITIONAL FRIEND OF ONE BOTH PARTIES, IDEOLOGICAL COMMITMENT TO ONE SIDE, UNITED STATES MILITARY BASES THREATENED, RAW MATERIAL SUPPLY THREATENED, ETC.
$P_4{}^{1,2,\ldots,n_4}$	STRATEGIC OBJECTIVE	ENGINEER A COUP D'ETAT, STALEMATE, ENCOURAGE NEGOTIATION TO SOLVE PROBLEMS, PUNISH ONE SIDE, MILITARY VICTORY...
$P_5{}^{1,2,\ldots,n_5}$	TYPE OF INTERVENTION	DIPLOMATIC, TAKE TO UNITED NATIONS, TRADE BOYCOTT, TRADE EMBARGO, BLOCKADE, SEND ADVISORS, SUPPLY WEAPONS, AIR SEA INTERDICTION, GROUND FORCES, TACTICAL NUCLEAR WEAPONS, ETC.

[21] *Ibid.*, p. 86.

Table XVIII-5. Methodologies and Components of Strategic Intelligence

METHODOLOGY	COMPONENT OF STRATEGIC INTELLIGENCE								PURPOSE FOR WHICH METHODOLOGY IS NORMALLY USED			
	BIOGRAPHIC	ECONOMIC	SOCIOLOGICAL	TRANSPORTATION & TELECOMM.	MILITARY GEOGGRAPHIC	ARMED FORCES	POLITICAL	SCIENTIFIC & TECHNICAL		DESCRIPTIVE	PREDICTIVE	REFERENCED (CHAPTER)
ANALOGY	X	X	X	X	X	X	X	X		X	X	XVII
GAME THEORY		X				X	X			X	X	XVII
WAR GAMING		X				X	X			X	X	XVII
LINK ANALYSIS	X		X	X		X	X			X	X	XVII
PSYCHO-HISTORICAL PSYCHO-LINGUISTIC	X						X			X		XVIII
SOCIOMETRY	X		X			X	X			X		XVII
CODING & CLASSIFICATION	X	X	X	X	X	X	X	X		X	X	XV
LINEAR PROGRAMMING		X		X		X		X		X		XVII
STATISTICAL ANALYSIS (VARIED)	X	X	X	X	X	X	X	X		X	X	XVI
DELPHI TECHNIQUE		X					X	X			X	XVIII
GENERATION OF ALTER-NATIVE FUTURES		X	X			X	X	X			X	XVIII
MODELS AND MODEL BUILDING		X	X	X	X	X	X	X		X	X	XVIII VII
MORPHOLOGICAL ANALYSIS				X				X			X	XVIII
CYBERNETIC MODELS SYSTEM DYNAMICS		X	X	X		X	X	X		X	X	XVIII
EXTRAPOLATION		X	X	X				X			X	XVIII
BAYESIAN ANALYSIS		X		X		X	X	X			X	XVIII
REGRESSION & CORRELATION		X	X	X			X	X		X	X	XVII
PROBABILITY DIAGRAMS		X		X			X	X			X	XVIII
GRAPHIC DEPICTIONS		X	X	X	X	X	X	X		X	X	XVII
CONTENT ANALYSIS	X	X	X	X	X	X	X	X		X	X	XV XIII

Models and Model Building

Models, as mentioned earlier, are abstractions or representations of reality. Stated another way, models are gross simplifications of reality. Only those critical portions of reality that are essential to decision making (or to any other purpose for which the modeling is performed) are represented in models. For example, in a model for calculating a missile system's cost, reliability of the missile would have to be represented by the model since it is a critical characteristic of the system; but color and shape of the missile would be inconsequential and would not be taken into account by the model.

Models, as discussed earlier, can be used to represent objects, processes, or functions. Very often models of objects take the form of a physical mockup. Physical objects can also be modeled symbolically by expressing the object in terms of its dimensions and weight. Processes can be modeled statically by portraying the sequence of steps or events involved in that process. Flow charts, for instance, are static models of processes. Processes can also be modeled dynamically. Simulations are dynamic models of processes. Models are sometimes theoretical constructs of processes *and* organizations, for example, Graham Allison's behavioral models of decision making under three different conditions of government.[22]

Although models are sometimes expressed in physical form, and often in verbal form, for the greater part, models are expressed mathematically. The advantage of mathematical models is that once they are constructed and validated, any number of different coefficients can be substituted in an equation. Hence, one basic model permits the researcher to determine any number of outcomes, given any changes of values provided to the model. For the greater part, large war games are

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[22]Graham T. Allison, *Essence of Decision: Explaining the Cuban Missile Crisis* (Boston: Little, Brown & Co., 1971).

composed of numerous mathematical models that were designed to address specific sub-elements of a situation; e.g., an economic model, a conflict model, a political model, and so on.

An example of a portion of a model—a mathematical model that was developed to compare missile systems' costs—is shown below:

$$C = C_L m - RC_M Nm - C_M(1 - R)m$$

In this equation, C is the output of the model, i.e., the dollar cost of a system which would be capable of destroying a specified number of enemy targets; and

C_M, C_L = cost coefficients (i.e., the cost per missile fired and the cost of maintaining a missile in a ready state),

R = ground reliability,

m = the number of missiles ready for firing on each salvo.

N = the number of salvos in the campaign.[23]

In this specific example, inputs to portions of the equation above would be outputs of other equations which were also models. One advantage of models is that they sometimes permit decisions to be made even though actual values for all elements may not be available.

Since models and games are so closely related, it is not surprising to find that the steps in developing models are similar to the steps involved in developing games. R. D. Specht identified four steps in model building: 1) identifying the factors that are relevant to the question being addressed; 2) selecting the quantifiable factors—factors which can be

[23]The example appears in R. D. Specht, "The Why and How of Model Building," *Analysis for Military Decisions,* pp. 66-67.

expressed numerically; 3) aggregating ("lumping together") the relevant, quantifiable factors in order to reduce the complexity of the problem; and 4) spelling out in quantitative terms the relationships between and among elements.[24] In instances in which a real world counterpart to a model exists, a researcher would employ a fifth step: he would attempt to validate his model by comparing the model's output with the output (or characteristics) of the real world system.

Employment of the model for calculating the cost of a missile system described above would require only a pocket calculator, paper and pencil. But obviously the most complex models would require the use of a computer. When computers are used and when programs are not available for performing certain functions, then specific programs must be developed. Although this step does not add to the complexity of the model, it does add to the cost of implementing the model.

Practically every academic discipline has an array of models, and models are used extensively in intelligence analysis and research. For example, there are models of transportation systems, models for predicting grain yield, models of missile systems, models of various types of conflict, e.g., ASW, EW, air battles, and so on. Before attempting to construct a model, the researcher is advised to determine what models already exist. Model building and model implementation are time-consuming and expensive tasks, particularly when long runs on a computer are required.

The library of works on modeling is voluminous. For examples of areas in which modeling has been performed, the following works might be examined: *Investigation of Model Techniques: Final Report,* DA Project 3H98-00-8000 (a somewhat dated but comprehensive work that covers a variety of

[24]*Ibid.*, p. 68.

technical applications of models)[25]; Brian J. L. Berry and Duane F. Marble, *Spatial Analysis: A Reader in Statistical Geography*,[26] and Ronald Abler, John S. Adams, and Peter Gould, *Spatial Organization: The Geographer's View of the World*,[27] (both works dealing with models applied to problems in geography but the analogs would be applicable to intelligence problems as well); Elwood S. Buffa, *Models for Production and Operations Management*,[28] and Peter Langhuff's *Models, Measurement, and Marketing*[29] discuss models appropriate for Economic Intelligence. James S. Coleman's *Introduction to Mathematical Sociology*[30] discusses numerous techniques that would be applicable to a range of Sociological Intelligence analysis and research problems. Other works of possible interest include James M. Beshers, *Computer Methods in the Analysis of Large-Scale Social Systems*[31] and Demitris N. Chorafas, *Systems and Simulations*.[32]

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[25]U.S. Army Electronic Proving Ground, *Investigation of Model Techniques* (Fort Huachuca, Arizona: 1961), AD 275 549.

[26]Brian J. L. Berry and Duane F. Marble, *Spatial Analysis: A Reader in Statistical Geography* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968).

[27]Ronald Abler, John S. Adams, and Peter Gould, *Spatial Organization: The Geographer's View of the World* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971).

[28]Elwood S. Buffa, *Models for Production and Operations* (New York: John Wiley & Sons, Inc., 1963).

[29]Peter Langhuff, ed. *Models, Measurement and Marketing* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965).

[30]Coleman, *Introduction to Mathematical Sociology* (New York: The Free Press, 1964).

[31]James M. Beshers, *Computer Methods in the Analysis of Large-Scale Social Systems* (Cambridge, Massachusetts: Joint Center for Urban Studies, 1965).

[32]Dimitris N. Chorafas, *Systems and Simulations* (New York: Academic Press, 1965).

Cybernetic Models and System Dynamics as Aids in Forecasting

In instances where elements that constitute a system can be defined and where the functions the system performs are understood (and, ideally, can be expressed in quantitative terms), cybernetic (feedback) models can be used as a basis for forecasting. Very briefly, a system is an interacting organization of people or objects that is united by some common purpose, objective, mission, or function.

Models used to represent systems must account for certain system characteristics; for example, they must define the boundary of the system. A system boundary specifies the components of the system which will be analyzed. The boundary includes all of the elements within the system that define or determine the system's behavior.

Models must also account for the control mechanism or the feedback of the system. Feedback mechanisms are means by which the functions of a system are regulated. In a closed system, the past behavior of a system, or *feedback*, is used to control its present and future behavior. In an open system, there is no feedback. Outputs result from inputs, but inputs are not affected by outputs in an open system. In simple systems there may only be one feedback loop. In highly complex systems, there may be numerous feedback loops.

Feedback loops are either positive or negative. A positive feedback loop is one in which an activity or function continues and, in effect, gains momentum as it progresses. An example of a positive feedback phenomenon in an ecological system would be a geometric increase in the population of a species when its predators had been eliminated. A negative feedback loop, on the other hand, is one that constantly limits a function. A thermostat that turns off a furnace when a certain temperature level has been reached is an example of a negative feedback loop. In an ecological system, a finite food supply that limits the size of a grazing herd would be an example of negative feedback.

In a military supply line, an automated system that constantly monitored the numbers and types of replacement parts on hand, automatically ordered replacements when a certain level of depletion had been reached, and automatically "logged in" new parts as they were received would be another example of a negative feedback loop. In simple form, this system would look like this (Figure XVIII-9). This inventory system, of course, would interface with other systems—a transportation system and a production system—and these systems could also be modeled similarly.

Simple systems can be represented simply at gross levels. But systems become complex very quickly. Furthermore, by their very nature, social systems in which values of the human components of the system must be taken into account are usually very complex. For example, Jay W. Forrester, a pioneer in systems dynamics, modeled a "cybernetic" town which contained three types of organizations, three types of dwellings, and three types of industries. In order to show the interconnections between the eighty-one possible combinations, more than 150 equations had to be used.

Interesting analogs can be seen among systems, and one reason for studying system dynamics is to uncover generalizations that would apply to a variety of systems. Karl Deutsch, in examining the relationship of cybernetic models to the political sciences, pointed out that the capabilities of a feedback system can be assessed in terms of the nature of the corrections that a system must make to achieve a certain output and the likelihood that the system will achieve the corrections within a finite period. These capabilities, in turn, are determined by 1) the systems information *load* with respect to goal-seeking operations; 2) the *lag* in the system's reaction (the greater the lag, the lower the probability of achieving an objective); 3) the *gain* expressed as a ratio of the intensity of the reaction and the basic information (dangers of under control or over control, e.g., a thermostat adjusted so finely that a furnace is constantly started and stopped); and 4) the *lead* in the system's reactive

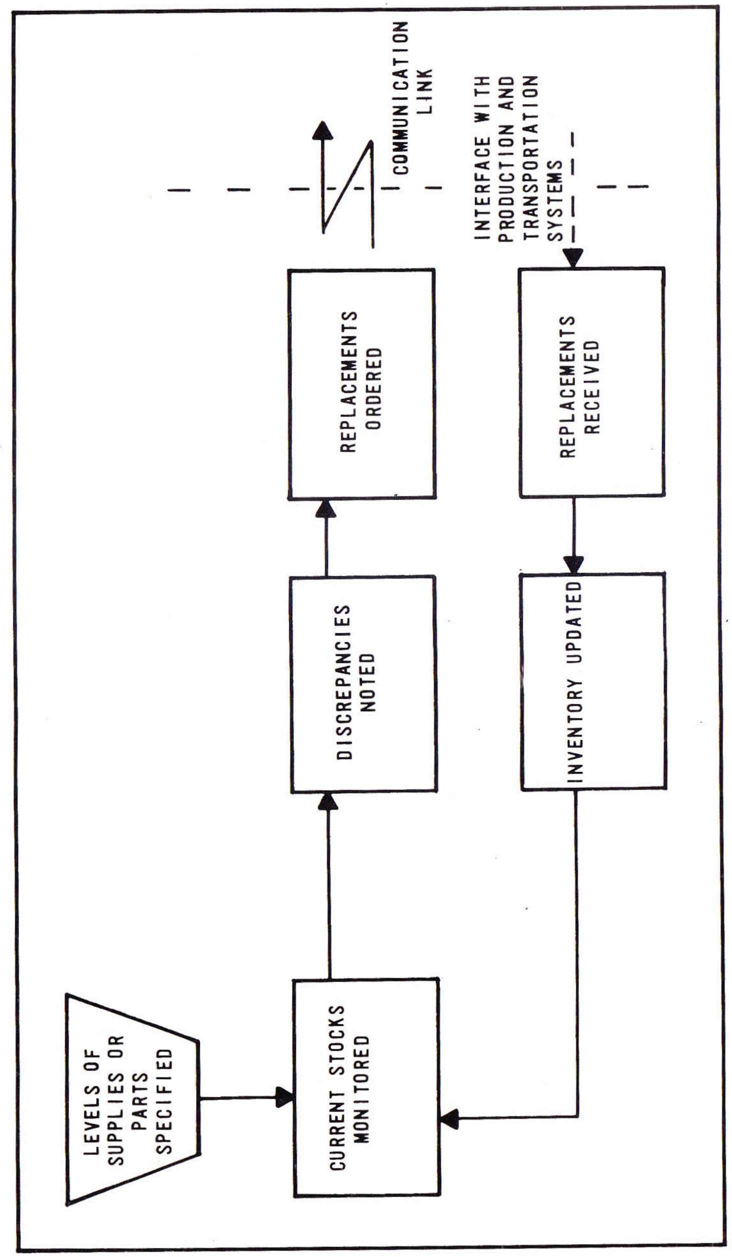

Figure XVIII-9. An Automated Supply System Exhibiting a Negative Feedback Loop

behavior. (An example would be attacking an incipient problem and taking appropriate action before the need became real).[33]

These observations, although theoretical, appear as relevant to hardware analogs as they do to real world command and control systems. For example, systems dynamics models could be constructed to describe the U.S.'s behavior in two similar incidents, North Korea's seizure of the *U.S.S. Pueblo* and the Khmer Rouge's seizure of the *Mayaquez*.

In both instances, the objective-seeking behavior related to the recovery of a ship and the crew. In the case of the *Pueblo*, there was a notable lag in the response of the system, and, as Deutsch pointed out, the probability of attaining an objective (i.e., recovering the ship) lessened as the lag increased. In the case of the *Mayaquez*, the *gain*, i.e., the ratio of the intensity of the system's reaction and the information (the facts of the seizure) seemed appropriate to the situation. Hostilities were confined essentially to the area in which the ship and its crew were detained. Whether or not the *lead* in the system's reaction was appropriate cannot yet be determined.

System dynamics modeling requires the same sequence of steps required for gaming and simulations described earlier: 1) defining the problem; 2) defining the relevant factors and the cause-and-effect relationships; 3) expressing the factors and relationships in a symbolic form that can be manipulated (e.g., a mathematical model); 4) obtaining values for the variables either empirically or from experts' judgments; and 5) comparing outputs of the model with real world counterparts and revising the model accordingly.

Although the steps in dynamic modeling are simply stated, their implementation may be considerably more difficult. It is

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[33]H. M. Dathe, "Cybernetic Models as Aids in Normative Forecasting," in Blohm and Steinbuch, *Technological Forecasting*, p. 42.

fairly easy to depict closed hardware systems analogs such as industrial control and regulatory systems or certain self-regulating ecological systems, but defining what constitutes the boundary of an economic or social system is another matter.

The predictive value of dynamic system modeling, like all models, depends upon the validity of the model and the correctness of the values that are manipulated in the model. In addition to the predictive value of system dynamics models, however, are the insights that modelers gain of the system that is being analyzed. The methodology of system dynamics modeling is itself a dynamic and on-going process of refinement which starts at a top level of generality and progresses downward through levels of greater detail (and complexity) as data become available. Consequently, the models can be refined and revised until their outputs correlate with the real world counterparts.

System dynamics modeling is one of the many techniques that falls under the rubric of systems analysis. Its uniqueness lies in the emphasis that is paid to the regulatory and control mechanisms in the systems.

For examples of system dynamics modeling applied to social problems, the works of Jay W. Forrester should be examined; for example, *Industrial Dynamics*,[34] *Urban Dynamics*[35] and *World Dynamics*.[36] Most works about systems

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[34]Jay W. Forrester, *Industrial Dynamics* (Cambridge, Massachusetts: MIT Press, 1961).

[35]________, *Urban Dynamics* (Cambridge, Massachusetts: MIT Press, 1969).

[36]________, *World Dynamics* (Cambridge, Massachusetts: Wright-Allen Press, 1971). An explication of *World Dynamics* can also be found in Dennis Meadows and Donella H. Meadows, *The Limits to Growth* (New York: Potomac Associates, 1972). (Paperback.)

analysis are also relevant to system dynamics modeling since the same basic techniques are used. One of the more readable books on the mechanics and philosophy of cybernetics—the basis of feedback and control of systems—is Norbert Wiener, *Human Use of Human Beings.*[37] System dynamics modeling would be a methodology most applicable to Political, Economic, and Sociological Intelligence research and analysis.

Summary

▷The quality of any prediction is a function of the nature of the phenomenon about which the prediction is made as well as the underlying assumptions about the phenomenon.

▷The quality of a prediction is also a function of the validity of the model as well as of the validity of the assumptions reflected in the model.

▷Some so-called predictive techniques provide the researcher with insights into system or organizational behaviors that may be more valuable than the predicted outcome that the technique provides.

▷Listed below are various methodologies described in the last two chapters and elsewhere in the text. The components of strategic intelligence in which the methodologies are or can be employed are indicated; however, no attempt has been made to indicate the degree or extent to which a methodology might be employed within any component. Clearly, some methdologies are much more relevant to one component than to another. The predictive or descriptive uses of the methodologies are indicated, and the chapters in which the methodologies are described are shown in Table XVIII-5.

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[37]Norbert Wiener, *Human Use of Human Beings: Cybernetics and Society* (New York: Avon Books, 1967). (Paperback.)

CHAPTER XIX
PREPARING THE REPORT

We should tailor our product for top policymakers in the government and the military services. These are busy men. Our prose should be lean and spare, not verbose and discursive. It should not include unnecessary detail or gratuitous information. It should be as clear and understandable to the lay reader as to the fellow professional. It should be written, in fact, for the No. 1 Lay Reader in Washington.

From the Directorate for Estimates
Organization and Operations Manual

This chapter discusses the last of the four phases of a research project, report preparation. In well-planned and executed research projects, report preparation begins as soon as data become available for analysis. In fact, report preparation can begin even in the data collection phase as bibliographies are compiled. As was the case in every other phase of the research project, planning is essential to ensure that enough time remains to prepare the report properly and to ensure that assistance is available when it is needed—assistance in the form of typists, technical art production specialists, editors, and reviewers. Invariably, report preparation requires more time than is anticipated. Unfortunately, by the time the researcher has reached the report preparation phase he typically has little flexibility in time and costs. Again, this makes prior planning all the more critical.

Report preparation connotes writing, and writing consumes a large portion of the report preparation phase. But checking footnotes, compiling bibliographies, reviewing, revising, and proofreading may require nearly as much time as the writing requires. Failing to take these tasks into account during the planning phase invariably results in frenetic activity in the days and hours prior to the time the report must be submitted.

This chapter discusses the mechanics of preparing the report, considers canons of formal, expository writing, and describes basic tools that can assist the writer.

Format

The format of a report is generally specified for research projects that are assigned. For example, the *Organization and Operations Manual* of the Directorate for Estimates (DIA) describes the formats for Defense Intelligence Estimates (DIE), the Special Defense Intelligence Estimates (SDIE), the Defense Intelligence Estimates Memorandum (DIEM), and the Defense Intelligence Estimates Staff Memorandum (DIESM).[1] Similarly, nearly every service specifies a format for staff studies as well as for specific types of intelligence studies. A word of caution: format specifications change periodically, so it is important that the latest documents be used as guides.

In self-initiated research projects, the researcher has more flexibility in selecting a format most appropriate to the research he is conducting. If the report will be submitted in fulfillment of an academic requirement, then policies of the institution must be followed. If the writer intends to publish his report in a professional journal, then the format required by the journal must be adhered to. Rarely are academic theses suitable for publication in professional journals without major revision and condensation. Theses invariably read like theses and even major publishing houses shun them in the form in which they were prepared originally. Supervisors or faculty advisers can recommend appropriate formats, and ultimately these people will pass judgment on the product.

Assigned research projects and self-initiated projects often serve different purposes, and it follows that formats may differ

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[1] Defense Intelligence Agency, Directorate for Estimates, *Organization and Operations Manual*, August 30, 1974. In addition, this document describes the steps in the production of various reports and contains a short section on style.

considerably. For example, research projects are assigned in order to obtain answers to specific questions. The competency of the researcher is taken for granted when the assignment is made. The product will be judged on its completeness and accuracy, of course, but the researcher will be evaluated only indirectly, if at all.

With self-initiated research projects, and particularly with research projects conducted as a part of an academic requirement, the research report is used as a means for evaluating the technical competency of the researcher. Consequently, content that would rarely appear in an assigned report may be very important in a self-initiated project. A review of the literature would be a case in point. In an assigned research project, the reviewers of the report will assume that all relevant and pertinent materials had been reviewed; thus large sections of a report devoted to this review would rarely be required. In academic research, however, advisers want demonstrable proof that the researcher had examined the basic works in his area and that his conclusions were based on reliable source data. Therefore, reviews of the literature might constitute an important part of the research product.

Another big difference between formats of assigned intelligence research projects and formats of self-initiated projects is the manner in which the findings are presented. In assigned projects, reports generally start with a statement of the problem, followed very closely by the conclusions or recommendations, and end with the justification. In most scholarly reports, on the other hand, the report first identifies the problem, then discusses the factors bearing on the issue, and ends with conclusions.

For the greater part, most research reports prepared as part of an academic requirement comprise three sections: 1) a preliminary section containing the title-page, approval sheet, preface and acknowledgements, a table of contents, and list of tables and figures; 2) the text of the report, including sections devoted to a statement of the problem, review of literature, findings, and conclusions; and 3) the reference materials in the form of bibliographies and appendices (if any).

A standard work in preparing theses and reports is William Giles Campbell's *Form and Style in Thesis Writing.*[2] In addition to sections on footnotes and bibliographic entries, the manual also contains sections on forms and format. Especially helpful are the numerous specimen forms. Another work that might be consulted is George Shelton Hubbell's *Writing Term Papers and Reports.*[3] This latter work is more comprehensive in the sense that it discusses steps in collecting and evaluating information as well as in preparing the report. However, it lacks the detail of Campbell's manual.

The writer who intends to submit his work for general publication by other than U.S. Government agencies should consult *A Manual of Style.*[4] This is considered to be the basic work relating to typographical and other rules for authors, printers, and publishers.

If a particular organization does not have its own style manual and if a report is to be published as an official U.S. Government document, then the *U.S. Government Style Manual* should be followed.[5]

A word of caution: manuals differ in subtle ways and later editions of the same manual may have important changes.

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[2]William Giles Campbell, *Form and Style in Thesis Writing* (Boston: Houghton Mifflin Company, 1954).

[3]George Shelton Hubbell, *Writing Term Papers and Reports* (New York: Barnes & Noble, Inc., 1962).

[4]The University of Chicago Press, *A Manual of Style* (Chicago: The University of Chicago Press, 1969).

[5]United States Government Printing Office, *U.S. Government Style Manual* (Washington, D.C.: Government Printing Office).

Regardless of the manual used as a guide for form and format, one manual should be used *consistently* and *exclusively.*[6]

Mechanics of Report Preparation

It would be presumptuous to propose one method for preparing the text of a report. Some writers have elaborate "warm-up" rituals involving sharpening dozens of pencils of a specified hardness, gathering all necessary tools and materials, and reviewing what was written previously. Other writers use what is available and commence with no ritual. Some writers compose in longhand on lined tablets, but others compose at a typewriter. Some writers prepare different drafts on different colored paper, whereas other writers prepare all drafts on plain white bond paper. Some notable writers write standing up (presumably at schoolmasters desks), but more writers write sitting down. The list of personal quirks in writing is a long one, but writers invariably develop certain procedures which they find most effective.

Comments below relate to procedures which have been tried and tested. They are offered as suggestions, not as hard and fast rules.

Prepare draft copy for ease in editing

All draft content should be prepared so that space is available for editorial changes and comments. This means wide margins and triple-spaced lines. Without this space, corrections

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[6]For example, the "correct" bibliographic form for a book with more than one author, according to Campbell's *Form and Style in Thesis Writing,* is to invert the order of the first author's name and then list the other authors' names in the normal fashion of first name, middle initial, and last name. Turabian, on the other hand, in *A Manual for Writers* (the manual used in preparing this text), uses the inverted form for all of the authors' names. Kate L. Turabian, *A Manual for Writers of Term Papers, Theses, and Dissertations* (Chicago: The University of Chicago Press, 1973).

are nearly impossible to make, and subsequent drafts will contain the same errors as the initial draft. Of all of the expenses incurred by report preparation, paper is the least consequential.

Cut and paste

Invariably, draft content must be rearranged for better continuity and emphasis. Rather than retyping entire pages, much time and effort can be saved by cutting and pasting. Rubber cement dries quickly and cleans up easily. It is indispensable for preparing draft content, illustrations, tables, and charts.

Prepare footnotes and bibliographic entries as writing progresses

These references should be prepared conscientiously as data are collected and copy is drafted. The researcher who attempts to reconstruct or to add notes at a later time invites trouble. Sources may no longer be available, specific items may be forgotten, and the notes may accumulate much faster than the writer suspected.

Have materials available

It is frustrating to begin to write and then to discover that needed materials are not within an arm's reach. The "warm-up" time in writing is notoriously wasteful. Ensuring that the materials that will be needed are present helps reduce this inefficiency.

Use outlines appropriately

It is inconceivable that a research report could be prepared without some kind of an outline. In fact, very often an outline is submitted at the point when the research project is assigned or approved. But the outline is a guide, not a mold, and as content is prepared, the writer may find that the original outline is no longer adequate for his purposes. Consequently, outlines should be adapted to the requirements of the writer and modified when necessary. There are limits to these

modifications, of course, and major changes would require approval from either the supervisor or the faculty adviser. Outlines are often used as "delaying tactics" by those who procrastinate. One can always claim that the outline needs more detail, and one can arrange and rearrange topics interminably. But this tactic does not get the report written. When deadlines approach it is imperative that the outline be put to rest and that the writer gets on with his major task, preparing the content.

Schedule work sessions

Starting up and winding down are, for the greater part, time-wasting activities. Efforts should be made to keep this wasted time to a minimum. One method is to schedule relatively large blocks of time for writing. An hour might suffice to record notes, but it hardly suffices to resurrect the continuity of thought of the previous day's efforts. Starting up activities consume the same amount of time regardless of how little content is written; therefore, the more time one can spend writing at any one sitting, the greater the efficiency realized.

Another method for shortening the starting up time is to end one day's effort in the middle of a section—a paragraph, for example. Then, when writing resumes the following day, the writer has a framework in which to continue. Getting over the initial step of putting the first word to paper is the hardest part of writing. Invariably words flow after a bit of preliminary pump-priming and this priming should be done at the conclusion of each work session.

Avoid interruptions

Interruptions are not only annoying; they may be destructive to a writer who is attempting to translate elusive concepts into written words. Some writers become "monastic" when they work. For example, they may retire to a solitary work space; they may take a telephone off the receiver; they may keep their office door closed; or, in a crowded office, they may arrange their desk so that they face a wall. These acts are not idiosyncrasies: they are methods which keep distractions to a minimum and thus increase efficiency.

Work at the same place

Efficiency can also be achieved by working at the same place as much as possible. This ensures that most of the necessary materials will be available when and where they are needed. Furthermore, distractions of new environments are eliminated.

Set daily goals

Goal-setting is another method for increasing efficiency. For example, some writers set a daily goal of a specified number of words or a certain number of typewritten pages. Whatever technique is used is a technique for self-discipline, and discipline is essential for preparing an acceptable research product on time.

Style

Adherence to standards of grammatical usage is basic to effective style. But style—an almost indefinable quality of good writing—requires more than correctness. If written material "reads well," if it communicates clearly, unambiguously, effortlessly, and concisely, then it has "good" style. In formal writing, the best style is usually the least obvious style. Good writing communicates concepts: it does not call the reader's attention to syntax. Listed below are suggestions for writing effectively.

Use the active rather than passive voice

For example, "We conclude that . . . " is stronger, more forceful, and more direct than "It is believed that." Or, "These data support the conclusion that . . . ," is preferred to "The conclusions are supported by the following data." The active voice is rigorous, less ambiguous, and invariably shorter.

Use the appropriate "person" consistently

For years a canon of scholarly writing required that the text be written in the third person. For example, with the exception of the "rules" described in this section which are written in the second person, this entire text is written in third person. For certain types of writing, however, adherence to third person usage requires more words. For instance, it is more direct and shorter to write "We believe that..." In place of "It is believed that," or "Now collate the data" in place of "The data should be collated now." Although canons of writing (to say nothing of taste) require that the writer be kept in the background and that personal pronouns (I, we, you, me, my, our, and us) should not appear in the text of a scholarly paper, there are times when this rule should be bent for clarity, directness, and conciseness.

Portions of *Organization and Operations Manual* cited earlier are written in the imperative rather than the declarative mode, and this also increases the directness and clarity. For example, the statement: "Make extensive use of headings and subheadings" is more direct than "Extensive use should be made of headings and subheadings."

Knowing when and how to deviate from the third person rule is a skill that must be acquired. For the sake of uniformity, however, the writer should use the same combination of person, voice, or mode consistently regardless of the combination chosen.

Use simple sentences

Nothing communicates so well as a simple sentence. Admittedly, excessive use of simple sentences may interfere with the "flow" of the discourse. But simple sentences are usually unambiguous, direct, and short. It is indeed strange that simple sentences are not used more often.

Avoid modifiers

Adverbs weaken sentences. Most of the time adverbs need not be used. Adjectives also tend to weaken sentences, but they are necessary at times. When subtle shades of distinction must be made, adverbs and adjectives should be used. Otherwise, it is better to write in nouns and verbs as William Strunk, Jr., advises.

Use orthodox language and expressions

At the risk of suppressing individual creativity, it is recommended that only accepted spellings, terminology, and abbreviations be used. When in doubt about the extent to which an English word is acceptable, the writer should consult Evans and Evans' *A Dictionary of Contemporary American Usage*, or Theodore M. Bernstein's *The Careful Writer.*[7] Unorthodox spellings, obscure abbreviations, and excessive use of highly technical terminology reflect poorly on the writer. Worse yet, they obscure the message.

Write at a level appropriate for the readers

In order to write at a level suitable for the reader, the researcher must analyze his target audience. He must consider the audience's level of education, background, and familiarity with the subject matter. Then he must adapt his writing accordingly. If decisions are to be made on the basis of what is written, then the material must be organized and structured in a manner that facilitates decision making by people who are usually very busy. On the other hand, if the purpose of a report is simply to present new information, the style may be more discursive. In any formal writing, cliches, colloquialisms, and most idiomatic expressions have no place, regardless of the audience.

Footnotes and Bibliographies

There are two kinds of footnotes. The first kind of footnote expands or clarifies the main text. This kind of footnote is used when its inclusion in the main body of the text would break the continuity of the discourse or distract the reader. The second type of footnote cites the source reference. This type of footnote indicates the writer's authority for making an assertion in the main body of the text. It would be used if a writer were paraphrasing or quoting another authority. In certain types of official reports, footnotes are also used to indicate non-concurrence by a dissenting member of the group submitting the report.

[7]Theodore M. Bernstein, *The Careful Writer: A Modern Guide to English Usage* (New York: Atheneum, 1965).

Footnotes provide a service to the reader. They indicate where additional information can be found, they identify the authorities whose observations and conclusions were cited, and they indicate that an assertion in the main body of the text reflects more than the writer's personal opinions. In the latter sense, footnotes also increase the writer's credibility.

Notes are placed at the bottom of the page or at the end of a chapter or at the end of the text (but before the bibliography). Different organizations have different requirements for placing footnotes. For reader convenience, however, it is best to place notes at the bottom of the page. Constantly requiring the reader to turn to the back of the text is annoying. Not surprisingly, notes at the end of chapters or at the end of texts are rarely read except by diligent scholars.

Although the form of a reference footnote may vary somewhat among different publishers and organizations, all reference footnotes contain essentially the same information: information relating to the author(s), title, facts of publication (place, name of publisher, date), and volume and page numbers. For periodicals, the same information is required except that the place of publication is seldom mentioned. For specific information relating to the various forms of footnotes, Kate L. Turabian's or William G. Campbell's manuals should be consulted. These manuals have been basic reference guides for students for decades.

Bibliographies usually list the sources that were consulted in preparing the report. In most cases many more works are used in preparing a report than are cited in a bibliography—works which every reader would assume were consulted by the author. Consequently, bibliographies typically list only the more relevant works bearing on the report. Any work that was

quoted or cited in a footnote, however, should be included in the bibliography. Bibliographies may also list books that the author recommends for additional information. Rarely do intelligence reports contain this type of bibliography, however.

Like footnotes, bibliographic entries may take several forms, depending upon the requirements of the publisher or sponsoring organization. The appropriate style book should be consulted before the bibliographies are prepared.

Bibliographic entries, unlike footnotes, must be organized or classified in some manner. One common method is to organize bibliographic entries as books, periodicals, and special reports. Within each group, specific entries might be arranged alphabetically by author, chronologically, or topically.

Footnotes and bibliographies are services provided to the reader. They indicate where specific information can be found and how the reference can be located. Forms that footnotes and bibliographies take are of secondary importance: the critical point is that the entries be *correct, complete,* and that the forms are used *consistently.* It is for this reason that only one style manual should be used for any single report.

Review and Revision

Before a report is submitted, it should have undergone numerous readings and probably revisions as well. The writer typically reviews and revises as he composes. After setting aside a section of draft copy for several days (or weeks, if time permits), the writer may review the copy again. The writer who has any aesthetic sensitivity to prose typically is dismayed to find that the words he so carefully articulated earlier may now be incomprehensible. Thoughts may no longer hang together, the syntax may be garbled, assumptions may not have been stated, and all of the mechanical errors in the draft that were overlooked may become embarrassingly evident. The only solution, of course, is to wield the blue grease pencil, cut and paste vigorously, and review again.

One of the more difficult things for a writer to do is to submit his draft to a jury of peers. It takes courage to reveal one's foibles to his colleagues. But as unpleasant as it may be, the step is absolutely necessary. Perspectives other than the writer's are essential for uncovering hidden biases, unsupported assertions, and faulty logic. Few writers can uncover these things in their own material.

How much should be reviewed and revised at one time depends upon the size of the work. If a book is being prepared, separate chapters would be logical portions to review and revise. If shorter reports are prepared, then an entire section of the report should be reviewed and revised at one time. Ideally, drafts should be reviewed as sections are completed. This precludes having to scrap the entire effort and starting over at a stage when time and funds may no longer be available.

If the writer is able to employ or use the services of an editor, he is indeed lucky. Good editors can uncover errors and weaknesses that are not apparent to the writer. Good editors can improve a text immeasurably, provided that the writer heeds the advice they give. In the absence of editors, colleagues may suffice, but rarely do the researcher's colleagues have the technical skills of a trained editor.

Reviews often result in revisions, and revisions are time-consuming and exasperating. But they are essential for removing the inevitable errors—errors of commission and errors of omission. For example, spelling errors have an insidious way of occurring. "Difficult" words are usually checked by the writer and misspellings of these words rarely appear in finished texts. More common are misspelled familiar words, words which the writer may have assumed were correct and never bothered checking. A draft may be fairly "clean" until it is submitted for final preparation, and then "mechanical" errors may be introduced—typographical errors, for example. Fast readers who are reading familiar text are often unable to detect these "mechanical" errors. So, again, it is important for someone unfamiliar with the text to proofread the copy.

Rarely does a major report, thesis, or book make it through the entire publication cycle without some error remaining. Nevertheless, an error-free product should be the goal of every writer. The trivial flaw that escapes the writer's and reviewer's attention seemingly takes on greater significance when it is seen in its final printed form, and it remains a source of embarrassment as long as the work is read.

Indispensable Aids

Next to a typewriter, blue grease pencils, index cards, scissors and paste, and all of the other impedimenta for writing, a number of basic reference guides are indispensable for the writer. First, of course, is a reliable dictionary. If the researcher is a serious writer, he soon discovers that dictionaries vary widely in quality and in coverage, organization, and format. The specific edition chosen is largely a personal matter. Although most desk dictionaries will suffice for normal use, the serious writer will find that an unabridged dictionary is a necessity. Unabridged dictionaries point out subtle distinctions between nearly synonomous terms. This helps the writer to increase his precision. Obviously, unabridged dictionaries contain more entries as well. A dictionary should be found on every writer's desk. More important, it should be consulted habitually whenever the *slightest* doubt as to the spelling or meaning of a word exists in the writer's mind.

In addition to standard dictionaries are dictionaries of technical terms. Technical dictionaries, dictionaries of antonyms and synonyms, and a thesaurus are very useful aids for gaining precision in terminology and for increasing variety of expression.

Even the most proficient writer encounters instances in which a subtle point of grammar must be clarified. For this purpose, any basic text in composition or expository writing can be used. One widely used work of this type is Porter G.

Perrin's *Writer's Guide and Index to English.*[8] At times, a question may arise as to the acceptable usage of an expression or term. Three useful works for clarifying these points are Evans and Evans' *A Dictionary of Contemporary American Usage,* Theodore M. Bernstein's *The Careful Writer* (mentioned previously), and Wilson Follett's *Modern American Usage.*[9]

Matters of style are treated extremely well in three works: William Strunk, Jr.'s and E. B. White's *The Elements of Style;*[10] Rudolf Flesch's *Art of Plain Talk;*[11] and Barzun and Graff's *The Modern Researcher,* cited previously. Strunk and White's short classic was originally prepared as a textbook by William Strunk, Jr. However, it is refreshingly direct, short, and not at all pedantic as many textbooks tend to be. Regardless of the researcher's specialty this little book should be found on every writer's desk.

Rudolf Flesch has gained national recognition in his attempt to convince writers and speakers to say things simply. The change in many government publications reflects, in part, the success of this crusade.[12] Finally, Barzun and Graff's *The Modern Researcher* is one of the few works of its kind which lives up to the publisher's "puff": "the classic manual on all

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[8]Porter G. Perrin, *Writer's Guide and Index to English* (Glenview, Illinois: Scott, Foresman & Co., 1972).

[9]Wilson Follett, *Modern American Usage: A Guide,* Edited by Jacques Barzun (New York: Hill & Wang, Inc., 1966).

[10]William Strunk, Jr. and E. B. White, *The Elements of Style* (New York: The Macmillan Company, 1959).

[11]Rudolf Flesch, *Art of Plain Talk,* (Riverside, New Jersey: Macmillan Publishing Co., Inc., 1962). Related to this work is *Art of Readable Writing* (Riverside, New Jersey: Macmillan Publishing Co., Inc. 1962).

[12]Various editions of the *Guide for Air Force Writing,* for example, the 15 July 1969, edition, are excellent cases in point.

aspects of research and writing." Although not prepared as a reference guide in the sense that Turabian's manual and Campbell's manual were prepared, the book can be used as a reference. Better yet, the book should be read by anyone performing research in any discipline.

Summary

▷Although the report preparation phase is the last phase in the sequence of activities in a typical research project, it need not be the last phase started. In fact, report preparation can begin as soon as data are available.

▷As was the case in every preceding phase, prior planning is important to ensure that sufficient time will be available to produce a quality product.

▷The form and content of a report should be tailored to the needs of the reader. If the report is a product of an assigned research project, then the formats prescribed by the agency or the assigning authority should be followed. If the report is a product of a self-initiated research effort, then the format should comply with established rules set forth in standard reference works, for example, the *U.S. Government Style Manual.*

▷Format and content apart, the manner in which a report is assembled is largely a matter of personal preference. The writer must determine what techniques and procedures work best for him, and then consistently and routinely adhere to his own standing operating procedures.

▷Styles of writing vary widely. The best style for expository writing, however, is that which is least pretentious. Statements made clearly, concisely, and unequivocally characterize the better styles for reports. Accepted standards of grammatical use, a minimal use of modifiers, use of the active rather than passive voice, and use of orthodox terminology are recommended for scholarly, technical writing.

▷Footnotes and bibliographies are usually present in formal research reports. Footnotes either cite the source or the

authority for an assertion made in the text, or they provide additional information to the reader. Footnotes and bibliographies are aids to the reader and should contain sufficient information to enable the reader to locate the works for his own examination. Regardless of the form or format used in footnoting, it should be used consistently.

▷Review and revision are continuous processes that occur during the entire time that a report is being prepared. However, prior to the submission of the draft for final publication, the draft should be reviewed critically by an editor (ideally), or by the writer's peers as an alternative. Revisions should be made as sections are reviewed in order to preclude one's having to rewrite the entire document when time may be extremely limited.

▷The written report is often the only tangible evidence of months or sometimes years of concentrated effort. The quality of the report reflects the quality of the research. Therefore, every attempt should be made to produce a high quality product.

CHAPTER XX
AN EXAMPLE OF A SMALL-SCALE INTELLIGENCE STUDY

Positive Unification Efforts Bearing Fruit After 27 Years

Headline in *The Korea Times,*
15 August 1972

Earlier chapters described the sequence of phases through which an intelligence research program typically passes and described various methodologies that were appropriate for intelligence research. This chapter describes a short research study conducted by one of the authors in the Republic of Korea (ROK) in 1972.

Not all of the steps described in earlier portions of the text were performed in this study. Because of constraints of time and resources and because the study was essentially self-initiated, the researchers had considerable freedom in defining the scope of the problem and in delineating terms of reference. Again, since the study was self-initiated, no review cycles were required. Unfortunately, nor was there any opportunity to influence the manner in which data were collected, as will be discussed later.

The purpose of this brief example is *not* to cite an ideal example of how an intelligence research problem should be approached, but rather to describe how an actual study was conducted in light of operational constraints that intelligence researchers typically encounter.

Background and Origin of the Problem

Ever since the cessation of hostilities in the Korean War, a state of low intensity conflict existed between North Korea and

the Republic of Korea. The intensity of the conflict varied over the years and hit a peak during the 1968-69 period when North Korea dispatched a team to assassinate President Park Chung Hee, when a force of over a hundred armed North Koreans raided and terrorized the Samchok-Ulchin region of the Republic of Korea, when the *Pueblo* was captured, and when the EC-121 aircraft was downed.

From 1969 to 1971, hostile acts committed by North Korean forces continued but the intensity and number of acts decreased. In the winter of 1971 and spring of 1972, North Korean diplomatic activities appeared to take on a new complexion. Although North Korean mass media still made vituperative attacks against the U.S., certain observers detected what appeared to be a conciliatory tone toward the ROK. On January 16, 1972, for example, an analyst of the 24th PSYOP Detachment in Seoul noted what appeared to be a departure from North Korea's previous position on the subject of unification.

Very briefly, the traditional stand of North Korea had been that a peace treaty between the North and South could be concluded only *after* the withdrawal of all U.S. forces from Korea. However, in mid-January, Korean Central News Agency (KCNA) wire service reports describing an interview that Premier Kim Il-song had with a Japanese Socialist Party official suggested that this position had been reversed and that now a peace agreement between the North and South could be concluded without the precondition of U.S. forces' actually being withdrawn.

The implications of this reversal in policy—if it were true—were significant for not only North Korean—ROK relationships but also for U.S. foreign policy *vis-a-vis* the ROK and North Korea. The perennial problem, of course, was determining whether or not the appearance of reality had any further substance in fact.

In its broadest terms, the research problem was defined as one of determining whether or not North Korea was changing

(or had changed) its previous position with regard to concluding a peace treaty with the Republic of Korea.

Planning the Research Program: Problem Definition

The small-scale research program that ensued was essentially self-initiated as stated earlier. Working closely with the 24th PSYOP Detachment on a larger basic research program contracted by the Department of Army, the researchers had neither time nor the resources to launch a thoroughly exhaustive study. Furthermore, the researchers were constrained to work with the materials that were available or that could be provided or obtained without necessitating an extensive data collection effort.

The problem definition phase ultimately resulted in the formulation of three hypotheses which will be described shortly. However, even before hypotheses could be formulated, an analysis of the consistency of North Korean policy statements as they appeared in North Korean mass media was made. This interim study had to be made in order to determine if the *perceived* change in North Korea's stand on concluding a peace agreement as reflected in its mass media was real. This shorter, interim research effort will be described briefly because it involved many of the analytical steps described in earlier sections of the text.

In order to determine if the apparent "change" in North Korean policy toward reunification was real or illusory, it was first necessary to determine how consistent North Korean public statements had been after Kim Il-song's interview with the Japanese Socialist Party leader had been reported. It should be noted at this point that very often the larger, overall research problem gives rise to smaller, more specific problems. In formal research programs, this "distillation" process is not at all uncommon and is a very important part of limiting the scope of a problem to manageable proportions, as discussed in Chapter IX.

In order to determine consistency in the public announcements by North Korea, all KCNA wire services from January 16 to April 30, 1972, that were received through normal distribution channels were reviewed. The alert reader who recalls the description of sampling in Chapter XVI will realize that this "sample" and the whole sampling process left much to be desired. For example, the wire service releases were provided by the Foreign Broadcast Information Service (FBIS). FBIS (at that time) monitored North Korean wire service transmissions on an *ad hoc* basis, according to an FBIS spokesman. If a transmission seemed important to the monitors, then it was transcribed; if the transmission was unrelated to FBIS's monitoring guidelines, then it was ignored. Consequently, the researchers had no idea of the number of wire service reports actually transmitted by KCNA, their frequency of transmission, or their periodicity. In short, the researchers had to use what they received. This condition is not unusual in intelligence research and analysis.[1]

Hundreds of wire service releases were examined of which seventy-eight pertained to peace proposals. This examination, it should be noted, involved both the exploratory and the investigative stage of data collection as described in Chapter XII. The wire service releases were those that were made between January 16 and April 30, 1972. These dates constituted a term of reference as described in Chapter IX.

Having examined and identified every wire service release relating to the problem of unification, the researchers classified and coded the releases according to which one of four different

---

[1]North Korea had a relatively low priority compared with North Vietnam and the PRC during this period, and it is understandable that, given finite resources, FBIS could not respond to a sampling plan on a relatively low priority target. Thus, the sample of data used by the researchers was of very questionable representativeness.

peace proposals suggested by North Korea at various times from as early as April 12, 1971, to January 10, 1972, was addressed in the specific release.[2] The steps involved in the coding and classification procedure were similar to the steps described in Chapter XV. Categories were established, and data (wire service releases in this case) were assigned to the categories on the basis of "fit."

After the data were classified, hypotheses were tested relating to the consistency reflected among the wire service releases. Ignoring the details for the purpose of this brief description, it was concluded that the wire service releases were highly consistent in the manner in which peace proposals were addressed from the period of January 16 to April 30, 1972. Although earlier (and more restrictive) proposals were still mentioned, the more militant proposals were attributed to foreign spokesmen. The most recent proposal—the one that seemed to signal a change in policy—was mentioned most frequently by party cadre members. This conclusion became an input to the larger problem addressed in the project, the problem of determining if, in fact, North Korea had changed its previous policy regarding the conclusion of a truce agreement with the Republic of Korea. This was the primary focus of the study.

Hypothesis Formulation

On the basis of the analysis of the consistency of North Korea's public statements pertaining to reunification (as well as other observables), three hypotheses relating to North Korea's "peace offensive" were formulated. The formulation of the hypotheses involved inductive processes described in Chapter VIII and reiterated briefly in Chapter XIV. The hypotheses were as follows:

[2]North Korea had made a number of different proposals over the years. Most of the proposals were "hard line" and obviously stood little chance of being accepted by the ROK. The point of the short analysis was to determine if the proposals made after Kim Il-song's new "epochal" proposal referenced any of the earlier hard line positions.

1) North Korea is attempting to reduce the hostile climate that existed on the peninsula for twenty-seven years. (For brevity's sake, this will be referred to as the "peace hypothesis.")
2) North Korea is maintaining the former level of tension. (This will be referred to as the "business-as-usual hypothesis.")
3) North Korea is carrying out a plan of deception by making what purports to be a peace proposal merely as a guise for concealing hostile intentions. (This will be referred to as the "deception hypothesis.")

An examination of these three hypotheses shows that the third hypothesis was not "incompatible" with the first two hypotheses, even though it was "opposed" to them. Needless to say, these three hypotheses did not exhaust all possible hypotheses.[3]

Data Collection

For the greater part, the researchers had neither the resources nor the authority to actually collect data. Instead, the researchers had to settle for data received through normal channels. In certain instances, data relating to incidents and conditions along the DMZ were provided to the researchers through J-2 channels. None of these data were in the form that required any detailed statistical analysis.

Analysis and Findings

Rather than describing all of the data ("observables") that were examined, a number of the more significant events

[3]As a matter of interest, one of the researchers' first tasks was to consider the range of possible hypotheses in order to establish a limited, workable number of plausible hypotheses. The reader will recall in Chapter XVIII that a minimum of three hypotheses should be postulated, as was the case in this instance.

examined will be described. Each major observable, or group of observables, was tested against each of the three hypotheses in order to determine under which hypothesis the observable was most plausible. (A Bayesian analysis as described in Chapter XVIII could also have been employed here.)

1) The lengthy KCNA release on January 15, 1972, described an interview Kim Il-song had with the editorial committee of the Japanese newspaper, *Yomiuri Shimbun,* in which Kim answered some "questions" raised by the newsmen on January 10. Discussing the problem of reunification, Kim proposed that:

> . . . a peace agreement . . . be concluded between the North and the South and the armed forces of North and South Korea be cut drastically under the condition where the U.S. imperialist aggressor troops are withdrawn from South Korea.[4]

It was not clear to the researchers what sequence of events was being proposed; e.g., would a peace agreement be *concluded* after U.S. forces were withdrawn or before? This ambiguity became significant in the further analysis because as the statement stood, any of the three hypotheses stated above seemed plausible. On the basis of this one input, the analysts hedged by giving equal weight to all three hypotheses.

2) Beginning in the middle of January, KCNA made reference to the January 10 peace proposal almost daily. Some of the initial ambiguity in wording was resolved in subsequent "interviews" with Kim Il-song and particularly in a meeting that Kim had with a Japan Socialist Party official, Kanji Kawasaki. It became quite clear that what was being said was that a peace agreement between the North and South could be concluded *before* U.S. forces were withdrawn. The

[4]Lest there be any confusion about the dates, Kim Il-song's latest "peace proposal" was made during an interview purportedly held 10 January. Issues raised at this interview were later clarified in another interview which was carried by KCNA on 15 January. This wire service release was received on or about 16 January by the 24th PSYOP Detachment analysts.

researchers were inclined to consider this "observable" as supporting the "peace hypothesis," although the "deception hypothesis" was not completely ruled out.

3) As was pointed out earlier, there was some question about the consistency with which North Korea treated the peace proposal issue. As analysis revealed, North Korea was highly consistent in its treatment of peace proposals, reverting only occasionally to a "hard line" stance and then attributing this stance to foreign spokesmen. This consistency supported the "peace hypothesis," but again the "deception hypothesis" was not completely discounted.

4) Analysis must consider the total situational context. In August 1971, Red Cross delegates from the North and South began meeting on a fairly regular basis to solve problems of relocating missing members of families and to solve other humanitarian problems. Initially, North Korea's coverage of the talks (by KCNA) was characterized by severe criticism of the tactics of the Korean National Red Cross (KNRC-ROK) and by statements supporting their own position. After January 1972, however, the tone of North Korea's coverage changed. Rarely was any direct criticism made of the KNRC, and the coverage became essentially factual and objective. The changing tone of KCNA's coverage reflected the progress that the delegates were making. After months of disagreements and stalemates, an agenda was finally agreed to by both parties, and full-scale talks were scheduled. Interestingly, a "hot line" telephone linking the North and South Red Cross delegations was installed—a precursor of things to come, as it turned out.

The toning down of vituperative attacks and the progress of the Red Cross meetings could not be separated, and together they strongly supported the "peace hypothesis." The "deception hypothesis" was ranked second.

5) Returning to the "peace proposals" again, by the middle of February whatever doubt the researchers had that what was being proposed by North Korea was a "new" proposal diminished rapidly as media from the Soviet Union and the People's Republic of China praised the new "epochal" January

10 proposal. Furthermore, the U.S. press reported meetings that *The Washington Post* correspondent Selig Harrison had with North Korean spokesmen in Japan. Although "unofficial," the input from Harrison was entirely plausible under the "peace hypothesis." Again, the researchers opted for the "peace hypothesis" rather than the "business-as-usual" or the "deception" hypotheses.

6) Exposure that analysts have to the "other side" is generally vicarious through media. But others along the DMZ in Korea had more direct contact with "the other side." There were two types of contact: one "symbolic" and the other real. The symbolic contacts were in the form of loudspeaker broadcasts which until early summer of 1972 rivaled the exchanges between Taiwan and the Chinese mainland for bitterness and abusiveness. The other contacts with the "other side" were engagements with armed infiltrators and agents. With respect to North Korean loudspeaker broadcasts, their tone changed noticeably in the spring of 1972. According to a statement made by ROK Defense Ministry, ". . . Communist propaganda, usually full of abusive and slanderous words, showed a considerable change in contents as well as in expression." In addition, the statement went on to say that the number of North Korean loudspeaker broadcasts declined from twenty-five a day to about sixteen broadcasts. This "observable" refuted the "business-as-usual hypothesis" but supported the "peace hypothesis." Naturally, the "deception hypothesis" still remained viable.

7) North Korean loudspeakers were not the only medium whose output changed. A monitoring of KCNA output revealed that the number of wire service releases containing anti-ROK statements declined from a high of 27.4 percent in January to 10.2 percent in April. This observable, like the preceding one,

also ruled out the "business-as-usual hypothesis," but supported the "peace hypothesis."[5]

8) Credibility of the word increases as the word is consistent with behavior. The researchers reasoned that if North Korea were in fact sincere in its purported "peace proposals," aggressive behavior, hostile acts, and the like, committed by North Korean personnel should decline. The "observables" in this case are summarized in a ROK Defense Ministry statement which is quoted in part below:

> North Korea has infiltrated neither armed guerrillas nor agents into the Republic of Korea during the last seven months . . . . Not a single case of spy infiltration has been detected during the seven-month period beginning last December.
>
> The number of ceasefire violations on the part of North Korea was also reduced to 7,308 during the first six months this year. This compares with 7,900 reported during the corresponding period of last year.
>
> Since the beginning of this year, the Communists have committed 168 cases of border provocations, which represent a 50 percent decrease from the like period of last year.[6]

The "business-as-usual hypothesis" was refuted unequivocally by this "observable." It was quite apparent that North Korea was not conducting its activities *vis-a-vis* the ROK in the same manner as it had in the past, The "deception hypothesis"

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[5]Determining this percentage reduction, as crude as the analysis may have been, involved some of the simple statistical techniques described in Chapter XVI. Determining whether the statements were hostile, neutral, or conciliatory involved the processes of coding and classification discussed in Chapter XV.

[6]*Seoul Haptong*, 0914 GMT 5 July 72

could not be excluded completely, but the complexity of the events militated against this hypothesis. In short, the hypothesis that was most strongly supported by the "observables" was the "peace hypothesis."

To summarize an analysis that took four months to perform, the researchers concluded that on the basis of extant observables (Figure XX-1), North Korea was in fact pursuing a "peace offensive" both in word and in deed. The "deception hypothesis" was not discounted, but it came in a very distant second. The "business-as-usual hypothesis" was discounted because too many observables directly refuted it.

Validation

A rare instance in which the conclusions of an intelligence researcher are corroborated occurred on July 4, 1972, when a seven-point communique was issued jointly by North Korea and the Republic of Korea. It stated, in part, an agreement on three principles of reunification; an agreement to refrain from "slandering and calumniating" the other side, and from committing armed provocations; and, reminiscent of the earlier Red Cross talks, an agreement to install a permanent direct telephone link between Pyongyang and Seoul. In short, the peace hypothesis was dramatically supported by this announcement.

* * * * *

Events that have transpired in Vietnam, Laos, and Cambodia since the time this short study was concluded have impacted significantly on both North Korea and the Republic of Korea. That the findings of this study have virtually no significance today epitomizes a notable characteristic of much intelligence research: it is highly perishable.

OBSERVABLES	HYPOTHESES		
	PEACE	BUSN.-AS-USUAL	DECEPTION
KIM'S INTERVIEW WITH YOMIURI SHIMBUN EDITORS	✓	✓	✓
KIM'S INTERVIEW WITH JSP OFFICIAL KAWASAKI	✓		✓
NO. TIMES PEACE PROPOSALS MENTIONED IN KCNA	✓		✓
CONSISTENCY ON MANNER OF ADDRESSING PROPOSALS	✓		✓
PROGRESS IN NK-RC DISCUSSIONS	✓		
CHANGE IN "TONE" OF NK'S COVERAGE OF RC DISCUSSIONS	✓		
"UNOFFICIAL" INTERVIEW WITH WASH POST REPORTER	✓	✓	✓
DECLINE IN NO. OF AND INTENSITY OF LOUDSPEAKER BROADCASTS	✓		
NO INFILTRATORS CAPTURED SINCE 1 JAN 1972	✓		
DECLINE IN CEASEFIRE VIOLATIONS (50% FROM SAME TIME PERIOD LAST YEAR)	✓		
DECLINE IN NO. ANTI-ROK STATEMENTS (KCNA)	✓		

Figure XX-1. Evaluation of Observables in Light of Three Different Hypotheses

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